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Mechanical Achievements of United States Railroad Administration

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Adverse decision of a man's case without hearing his side of the story is bad law and equally bad horse sense. Taking a crack at the United States Railroad Administration has become such an everyday proceeding that a counter blow is a welcome novelty. This statement by a high official of the Railroad Administration gives an inkling of some of the difficulties encountered when the railroads were taken over and sketches briefly the steps taken to overcome them. In scope it is confined to equipment and mechanical problems, those of most moment to machine-tool men. The figures quoted by the author show a healthy improvement in the state of the rolling stock and a locomotive reserve which should improve operating conditions.

IT IS not possible to set forth what the Railroad Administration has accomplished without taking into consideration the conditions which existed at and prior to the time the Government assumed control of the railroads. In order to comprehend the difficulties encountered by the Railroad Administration and to appreciate what has been accomplished, a knowledge of some of the conditions found in motive power and car departments will be necessary. The following statement of conditions is therefore given:

The Federal Government assumed control of the railroads not because it was desirous of adding to the enormous task it already had on hand, but because it was forced to do so as a war measure, for the railroad machine had, to an alarming extent, ceased to function, and in the emergency which confronted the nation it was essential that the railroads should function at their highest degree of efficiency.

The statement has been made and is generally accepted that the principal cause for the railroad's failure to function was the car and locomotive shortage, and while this correctly represents the situation so far as the shipper was concerned, from a standpoint of railroad operation such a condition did not exist.

When a railroad or a number of railroads in a section of the country are congested with cars, there can be, in so far as those railroads are concerned, no car shortage. When the shops and roundhouses on a railroad or a number of railroads in any section of the country are blocked with locomotives undergoing or awaiting repairs, in so far as those railroads are concerned there can be no shortage of locomotives. These conditions existed on every railroad which was congested with traffic at the time the Railroad Administration assumed control. Therefore congestion was not primarily due to shortage of cars or locomotives, but to the inability or failure to use to their maximum efficiency the cars and locomotives on hand.

It was not possible at the time the railroads were taken over to say to what extent the condition of locomotives and cars was responsible for the situation which existed, and as the Railroad Administration had at that time no mechanical department organized to check up shop practices and handling of equipment at terminals and to outline plans for improvement, the Interstate Commerce Commission was asked to assist in obtaining accurate information relative to the general situation.

The records of the Commission contained much valuable data with respect to general conditions throughout the country. The inspection forces of the Commission were assigned to various congested terminals, particularly throughout the East and Middle West, to investigate and make daily reports of the actual conditions of locomotives and cars and train movements.

These reports showed that a serious condition existed on account of the number of cars in bad order at various terminals and also on account of the general defective and run-down condition of motive power, which, together with overcrowded and inadequate shops and roundhouses, had resulted in trains being held at terminals on account of shortage of efficient motive power. This also seriously slowed up movement on the road, often to the extent of blocking several divisions. The immediate remedy for these conditions was not so much the building of new locomotives and cars as the proper maintenance of locomotives and cars that were in service and more prompt movement of trains.

At a time when the various war industries were clamoring for skilled mechanics at almost any rate of pay, and the supply had been substantially decreased by the selective draft, the problem of improving the condition of locomotives and cars in the midst of exceptionally severe winter weather was an extremely difficult one.

A survey of the situation indicated that shop facilities were sufficient if efficiently used. Therefore, one of the first acts of the Railroad Administration was to nationalize the railroad-shop facilities so that locomotives could be assigned to shops where repairs could be made regardless of ownership.

Prompt handling of locomotives was seriously hampered by the poor condition of roundhouses and the lack of facilities at many points to make running

repairs to large locomotives. Roundhouses built 20 years or more ago for locomotives in service at that time, were still being used to house locomotives more than twice the size of those for which they were designed. Consequently, repairs had to be made out of doors or at open roundhouses with a temperature below zero.

Similar conditions existed in shops at many points for it was found that there had been no improvements made for many years and consequently there were no crane facilities or proper tools with which to handle and make repairs promptly to modern power. This was resulting in locomotives being held out of service an excessive period of time receiving classified repairs. Only two methods of improving the general condition of equipment existed; to increase the shop facilities and forces or to use more efficiently the facilities and forces which were available. Increasing the facilities and forces under war conditions was clearly impossible; this left as the only practical means of improving equipment conditions the adoption of some plan whereby existing facilities and forces could be made to produce greater results. The first step in this direction was to call on the representatives of the organized railroad employees to agree to a modification in certain particulars of their agreements and contracts with the various railroad companies relative to hours of labor, and to agree to modifications, under proper safeguards, of the rules governing the promotion of apprentices and helpers to mechanics. This was agreed to by the employees' organizations and on Feb. 14, 1918, a letter directing the manner in which this should be done was sent to the representatives of the employees and to the various railroad companies by the Director General and immediate steps were taken to increase the shop hours of men working in locomotive repair shops and roundhouses to 70 per week, where the condition of equipment required it.

TABLE I. NEW LOCOMOTIVES ADDED TO EQUIPMENT JANUARY 1, 1918, TO APRIL 30, 1919

1918	Constructed by Locomotive Builders	Constructed in Railroad Shops	Russian Government	Total
January	103	20	..	123
February	92	21	49	162
March	123	21	93	237
April	135	37	40	212
May	195	26	18	239
June	167	25	..	192
July	174	12	..	186
August	203	14	..	217
September	251	18	..	269
October	265	19	..	284
November	203	20	..	223
December	253	22	..	275
1919				
January	190	17	..	207
February	127	11	..	138
March	231	13	..	244
April	196	14	..	210
Total	2908	310	200	3418

The average increase in locomotive shop hours for the entire country amounted to about 16 per cent., and the effect became immediately apparent in the increased number of locomotives repaired per week in comparison with the most accurate records available for the corresponding week of the preceding year. This increase in shop hours applied to roads where locomotives were in good condition and shop facilities ample, as well as to roads which were not so favorably situated, and enabled a comprehensive program of nationalization of railroad-shop facilities over the entire country to be carried out. Locomotives from roads where shop facilities were not sufficient and motive power was in bad condition were sent to shops on other lines for repairs. This distribution of locomotives was so arranged as to reduce, in many instances, distance to the repair shops. Therefore the cost of transporting locomotives to the shops was no greater and under this plan all shops were kept working at their maximum capacity with a full force.

The plan of considering the condition of equipment as a whole and taking steps to improve it by uniformly increasing shop hours on all railroads in the country and utilizing to their full capacity the facilities of all shops, which could only be done under Federal control, is really what improved the condition of the locomotives and cars. Not only was the existing congestion of traffic cleared up, but trains were moved by locomotives in good repair, with promptness, and with reasonable assurance that they would reach their destination without delay. The result of the policy of nationalizing railroad-shop facilities made it possible to overhaul and in some cases practically to rebuild at other line shops, 3003 locomotives for railroads which lacked sufficient shop space and shop organization, thus improving the general situation without detriment to the railroads that furnished this help. In addition to this, during the period Jan. 1, 1918, to Apr. 30, 1919, there were 310 new locomotives constructed in various railroad shops under Federal control. See Table I. Investigation was also made of the facilities of the different locomotive builders with a view to having locomotives repaired by them, but it was found that this could not be done to any material extent without disarranging their schedule of new work both on domestic and foreign locomotives. In view of the need for both, this was not considered advisable, although both the Baldwin Locomotive Works and the American Locomotive Co. did endeavor to make use of surplus facilities to repair what locomotives they could without interfering with their output of new locomotives.

Illustrative of the improvement in motive power and the changed conditions in railroad shops is the fact that it was possible to grant the request of the Baldwin Locomotive Works, made on Sept. 13, 1918, for assistance in machining locomotive frames, driving boxes, rods, etc., to facilitate the construction of locomotives for our Army in France, and this work was continued in railroad shops until the armistice was signed.

TABLE II. CLASSIFICATION OF STANDARDIZED LOCOMOTIVES AND NUMBERS BUILT

Specification	Type	Number
1A	Light Mikado	625
2A	Heavy Mikado	233
3A	Light mountain	40
4A	Heavy mountain	15
5A	Light Pacific	46
6A	Heavy Pacific	20
7	Light Santa Fe	94
8	Heavy Santa Fe	175
9	6-wheeled switcher	255
10	8-wheeled switcher	175
11	Light Mallet	30
12	Heavy Mallet	106
Standard consolidation		30
Total		1,844

NOTE.—In addition to the above, 86 locomotives are on order, but the types of these locomotives have not as yet been decided.

The increased working hours in railroad shops under the instructions issued on Feb. 14, 1918, were continued until after the signing of the armistice, and without this loyal support from the employees the increased number of locomotives repaired during this period and the assistance rendered locomotive builders would not have been possible. After the signing of the armistice shop hours were reduced to nine per day, effective Nov. 25, and to eight per day, effective Dec. 9.

In addition to the vigorous action which had been taken to improve the condition of existing equipment, the necessity of adding to the available stock was recognized and designs were worked out for standardized locomotives and orders placed for their construction.

Specifications were prepared and orders were placed for 1844 locomotives of standardized types, divided as shown in Table II.

These locomotives are provided with every known device for efficient and economical operation. All the road locomotives with the exception of the light Pacifics have mechanical stokers and locomotives not provided with stokers are furnished with coal pushers. All locomotives are equipped with superheaters, brick arches, automatic fire doors, power grate-shakers, power reverse gears, and electric head and cab lights.

This order was divided between the American Locomotive Co., Baldwin Locomotive Works and the Lima Locomotive Corporation. The first locomotive was turned out by the Baldwin Locomotive Works on July 4, 1918, and it is expected that the order will be completed so as to have this entire consignment of locomotives in service early in July, 1919.

TABLE IV. TON-MILES, FREIGHT LOCOMOTIVE AND TRAIN-MILES

1918	Total Revenue Ton Miles	Total Freight Locomotive Miles	Revenue Ton Miles Per Locomotive
January	24,665,552,565	55,442,425	819,181
February	26,591,083,000	55,251,000	865,116
March	31,341,327,931	59,039,387	1,099,927
April	34,250,247,914	62,066,394	1,125,875
May	33,978,650,000	64,983,000	1,085,000
June	34,336,703,000	61,656,000	1,171,000
July	35,979,291,000	62,210,000	1,241,000
August	35,660,217,000	60,970,000	1,263,374
September	35,763,381,000	61,459,000	1,224,360
	Total Ton Miles	Total Train Miles	Total Ton Miles Per Train Mile
October	39,548,562,000	54,843,000	721
November	35,533,026,000	51,293,000	693
December	33,659,507,000	50,402,000	668
1919			
January	30,383,169,000	48,463,000	627
February	25,681,943,000	40,857,000	629
March	28,952,925,000	43,972,000	658

NOTE—The above figures from January to September inclusive were taken from forms originated by the Bureau of Railway Economics.

From October to March inclusive were taken from forms prepared by the Operating Statistics Section of the Division of Operation which gives the data on a slightly different basis.

Reasons for Locomotive Standardization

The locomotives were built from standardized designs for various reasons, the principal of which are as follows:

First—To reduce to a minimum the time required to prepare drawings, patterns and dies, and thus enable deliveries to begin quicker than where separate drawings and patterns would have been necessary for each lot of locomotives allocated to a particular road.

Second—To secure quantity deliveries.

This method of construction has resulted in delivery being made at a quantity rate which could not have been approached had the locomotives been ordered to individual designs.

The increase in the rate at which standardized locomotives can be turned out is clearly shown by the following comparison of two of the principal shops of the American Locomotive Co. during a portion of July and August when the locomotives built were of individual design, with a similar period in September and October when they were building standardized locomotives.

During five weeks, beginning July 20, an average of 13½ locomotives per week were turned out at the Dunkirk plant, while during five weeks, beginning September 14, an average of 19½ locomotives per week were turned out at the same plant. For Schenectady, during the five-week period beginning July 20, an average of eight locomotives per week were turned out, while for the corresponding period beginning September 14, an average of 13⅔ locomotives were turned out. It will be seen that the increased production due to the standardized locomotives was about 50 per cent.

Third—It has also provided a supply of equipment, the parts of which are largely interchangeable, which is available for use anywhere in the event of congestion. This removes the necessity of carrying a large stock of repair parts for each locomotive and avoids the delay which results when repair parts must be ordered from a distant owning road.

Standardized Cars

The freight-car situation was handled along the same lines as were the locomotives. After careful consideration, designs were prepared and orders placed for the following cars, about 50 per cent. of which were delivered prior to May 30, 1919: 25,000 single-sheathed box cars of 50 tons capacity; 25,000 self-clearing steel hopper cars of 55 tons capacity; 25,000 double-sheathed box cars of 40 tons capacity; 20,000 composite gondolas, with drop doors, of 50 tons capacity, and 5000 low-side gondolas of 70 tons capacity.

In addition to the designs for freight cars for which orders have been placed, designs have been prepared for all-steel box cars of 50 tons capacity, refrigerator cars of 30 tons capacity, general-service gondola cars of 50 tons capacity, steel-framed stock cars of 40 tons capacity, flat cars of 55 tons capacity, oil tank cars o 7000 gal. capacity, oil tank cars of 8000 gal. capacity, oi tank cars of 10,000 gal. capacity, acid tank cars of 7000 gal. capacity, acid tank cars of 8000 gal. capacity, and acid tank cars of 10,000 gal. capacity. While no cars have actually been built from these drawings, they are available at any time that the traffic needs show them to be desirable.

Plans for All-Steel Cars

Complete plans and specifications of all-steel baggage cars in both 60-ft. and 70-ft. lengths have been prepared, and tentative plans prepared for 70-ft. steel coaches, and for steel passenger and mail, passenger and baggage, passenger, baggage and mail cars.

Under private operation, at many points complete

organizations for the maintenance of a comparatively small number of locomotives or cars were maintained side by side, which resulted in a duplication of work, heating plants and supervising forces. Wherever a saving could be made without adversely affecting efficiency such duplicate facilities were eliminated. Consolidations have been made at 820 points and the annual saving effected thereby amounts to $4,200,000. Additional consolidations are under way and will be made as fast as complete investigations and necessary minor changes can be completed.

In connection with this work extensive investigations were conducted covering shop and engine-house operation, resulting in changes and improvements which have materially increased the output. It was also possible by rearranging the method of handling work in engine houses, to release hundreds of employees who were sorely needed in other departments, and the saving effected in engine-house operation by such reduction in force, while not obtainable for all railroads, on one railroad alone amounted to $15,000,000 per annum.

It was also possible by rearranging methods of handling locomotives at terminals to secure greater efficiency from such locomotives and thus overcome what otherwise would have been a shortage in motive power. For example, on one railroad an appeal was made for an additional assignment of 25 Mallet locomotives, but by changing the method of handling work at the important terminals on that line the delay to locomotives at such terminals was reduced to a minimum, and by thus increasing the efficiency of the locomotives in service, it was found that it would not be necessary to build and furnish the additional 25 Mallet locomotives, valued at $2,145,400. Instead of this they were able to release for service on other lines nine Mallet locomotives, valued at $772,344.

Improvement in Condition of Locomotives Under Federal Control

The condition of motive power on all lines under Federal control has shown a gradual improvement, and the locomotives in service are in much better condition than they were 18 months ago. On some lines that last spring required extensive assistance from other line shops, the condition of power has shown such a marked improvement that they are now doing all of their own repair work, and in addition are repairing locomotives for other lines.

The tabulations furnished by the railroads show an average increase of 20.93 per cent. each week in the number of locomotives receiving classified repairs during the period of increased shop hours.

Table II. shows the number of locomotives in actual service and the number stored which have been repaired and made ready for service.

The locomotives in the column headed "Number Repaired and in Storage Ready for Service," are being held in reserve and are available for service with any increase in business beyond the capacity of the locomotives now being used. With this stored power, together with the deliveries which are yet to be made by the builders, there is no doubt that all lines under Federal control will have a sufficient number of locomotives in serviceable condition to handle all business offered.

Tables IV and V are included to illustrate the changes in the condition of the rolling stock as indicated by the miles traveled and loads carried. Comment is hardly necessary, as the figures speak for themselves.

TABLE V. LOCOMOTIVE FREIGHT TRAIN AND FREIGHT CAR PERFORMANCE

1918	Average Miles Per Freight Car Per Day	Average Miles Per Locomotive Per Day	Tons Per Loaded Freight Car Mile	Tons Per Freight Train Mile
January	18.3	59.4	29.6	577
February	23.9	65.8	28.8	625
March	24.9	66.8	28.1	673
April	25.9	68.0	29.4	696
May	26.4	67.0	27.6	663
June	26.8	64.9	28.3	698
July	26.5	64.2	30.1	723
August	26.0	64.6	30.1	729
September	26.8	65.0	29.7	728
October	26.2	*	29.7	721
November	24.6	*	29.5	693
December	22.8	*	29.8	668
1919				
Janury	21.4	*	29.0	627
February	20.3	*	27.7	629
March	20.4	*	27.6	658

NOTE.—The decrease in average miles per freight car per day is due to the large surplus of freight cars which are in storage because of decrease in traffic. *Information not available.

Obsolete Machinery Replaced

As previously stated, many shops and roundhouses were found to be obsolete. In order to overcome this condition extensive improvements, including the replacement of obsolete machinery and tools with those of a more modern design, have been started and are now under way on many lines of railroads, and when these are completed, shops and roundhouses on those lines will be in condition to take care of the most modern power with efficiency. These improved facilities should make it possible to prevent power from ever again getting in the condition it was at the time the Government assumed control.

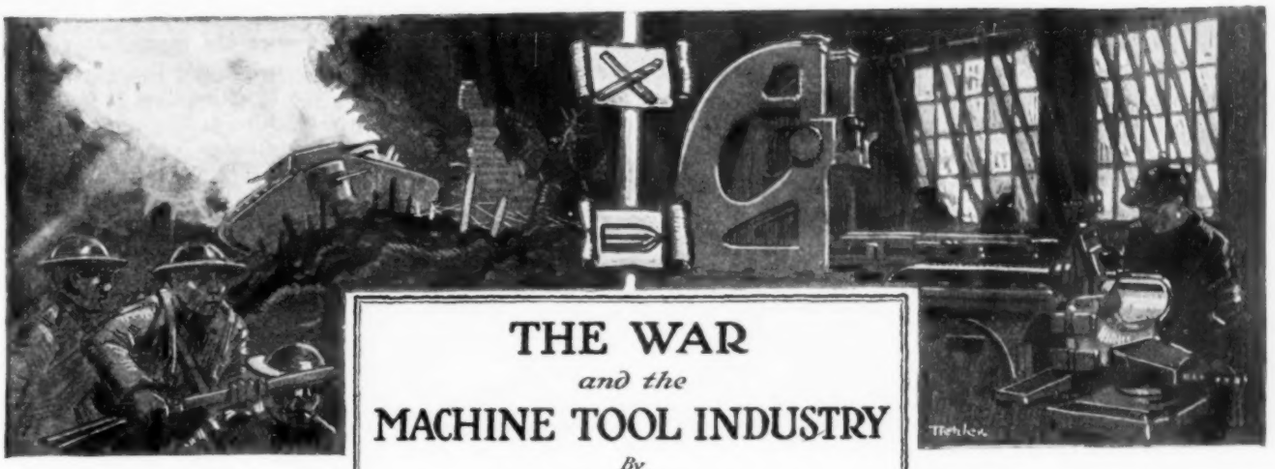
TABLE III. LOCOMOTIVES IN SERVICE AND IN STORAGE

Month—1918	Number In Actual Service	Number Repaired and in Storage Ready for Service
January	49,204	379
February	49,700	323
March	49,361	382
April	49,688	386
May	50,199	397
June	51,236	450
July	52,969	798
August	53,398	708
September	53,774	994
October	53,874	901
November	53,050	1021
December	53,280	1167
Month—1919		
January	53,113	1582
February	52,704	3009
March	52,717	4043
April	52,598	4604
May	52,809	4477

How Would You Prevent Oil from Discoloring Finished Surfaces?

By C. P. Bloomer

Regarding your query on page 802 let me suggest a liberal use of kerosene oil once a week as a preventive. Saturday is a good day to apply it, as the machines are idle over Sunday and if the kerosene is "sloshed" on the sides, etc., and through the various plain bearings, you will have little bearing trouble or discoloration. The kerosene smell is mostly gone by Monday morning. To remove the discoloration already present use a little wood alcohol on waste.



THE WAR *and the* MACHINE TOOL INDUSTRY

By *Fred H. Colvin*,
PRINCIPAL ASSOCIATE EDITOR, AMERICAN MACHINIST

The distribution of the machine-building capacity of the country has been more or less disputed. This shows for the first time accurate data as to just what each section was doing at three periods; before the great war, at the time of our entry into the struggle and at the close. The map shows this graphically and gives Ohio first place, with Cincinnati almost as large as the second state, Connecticut. If the shops across the river in Kentucky were included, it would put Cincinnati in the lead.

NOW that the abnormal demand for machine tools due to war needs has subsided, it is not only interesting but also profitable to survey the field and see exactly what has happened during the last four and a half years. Previous to the war there were about 300 concerns in this country making metal-working machinery. These concerns employed about 30,000 people and had an output of approximately $50,000,000 per year. It is estimated that in the machine-tool plants previous to the war about 30 per cent. of the product was built for export.

The year 1914 had seen a distinct depression in the metal-working trades and it was not until the late fall that the demand from Europe, as well as from concerns in this country having European contracts, began to be felt. During the next two years the great majority of the machine tools built were either for the manufacture of munitions by the Allies or for the manufacture of munitions in this country for them. A number of new firms entered the machine-tool field, for the most part confining their activities to the manufacture of special machinery or the copying of simple standard machines. According to the statistics of the Machine-Tool Section of the War Industries Board, however, the number of new firms going into the machine-building business after our entry into the war was not as great as many have supposed. The increase from July, 1914, to April, 1917 was considerable; from 310 to 367 or nearly 20 per cent.

Machine-tool builders and users generally are familiar with the activities before the formation of the Machine-Tool Section just referred to, and nearly all have had occasion to become acquainted with its workings from securing its assistance in procuring material and needed machinery, as well as in assisting the compilation of statistics by making weekly and monthly reports. This information included an inventory of all the available machine tools, not omitting those which were held on the docks at various ports for shipment; this amounting to approximately $10,000,000. Coupled with the data as to the possibilities of manufacture, this information made it possible to advise the various Governmental departments as to the placing of orders for machine equipment for various contracts.

Figs. 1, 2, 3 and 4, and the tables give an interesting resume of the data as to cause of delay, distribution of products, and equipment purchased through the purchasing commissions for the various governments. The figures are for the month of October, 1918, when production was at its height.

This taking of machines from the docks required well-balanced judgment to avoid the antagonizing of foreign governments, and most of all, to prevent disturbing manufacturing capacities in this country. If, for example, certain machines could be secured direct from the builder it was better to do so than to take machines from the dock and so perhaps cause the builder to close his shop or disturb his organization. On the other hand, machines like cylinder grinders and those needed for toolroom work, were taken at once to enable Ford and others to get started on Liberty motor work, as the builders could not supply them.

In order to keep advised in regard to the condition of the industry a monthly questionnaire was sent to each firm. The data given indicated the condition of each plant and if falling behind in production indicated the cause, and knowing this, it was often possible to help rectify the trouble. This data also indicated from its percentage of war work, etc., to what priority it was entitled to in the way of securing transportation privi-

leges, fuel, materials, labor, etc., and was kept for ready reference for use of the various departments.

It is interesting to learn that only 9.2 per cent. of the employees were working more than 10 hr. a day in May, while in October 61 per cent. exceeded the 10-

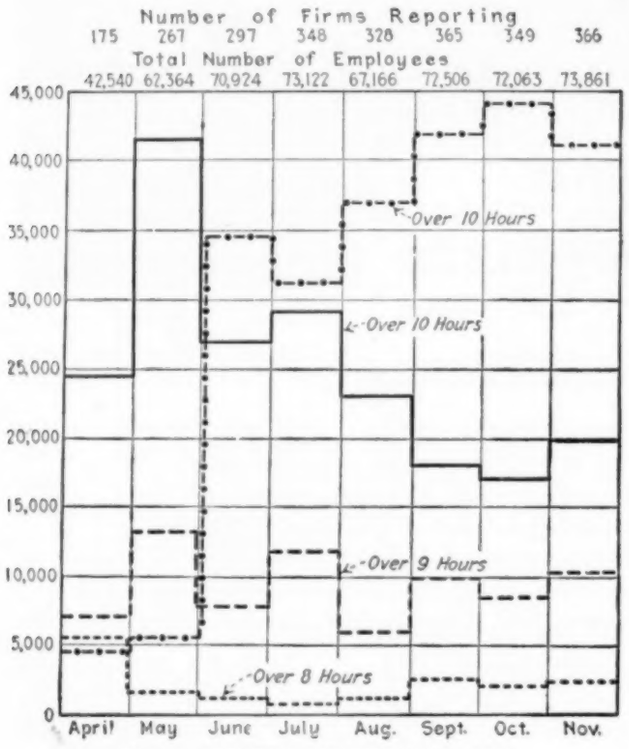


FIG. 1. LENGTH OF WORKING DAY

hr. limit. The comparison between the standard working day and the actual working day is computed as follows: The standard day is the number of hours for which straight time is paid. The actual day is the total number of working hours including those for which overtime is paid. It is also well to note that

TABLE I. CAUSES OF DELAY IN FILLING SCHEDULE

	May, 1918	Oct., 1918
Firms reporting	257—100%	345—100%
Firms reporting delays	71—27.6%	223—65%
Firms reporting no delays	186—72.3%	132—35%
Firms reporting labor troubles	31—12%	6—1.7%
Firms reporting labor shortage	132—51.4%	187—54.2%
Firms reporting shortage of material	75—29.2%	92—26.6%
Firms reporting shortage of fuel	13—5.0%	4—1.2%
Firms reporting shortage of transportation	38—14.8%	21—6.1%
Firms reporting shortage of cars	27—10.5%	8—2.3%
Firms reporting Government delay	14—5.6%	19—5.5%

while labor shortage had increased from 51 per cent. in May to 54 per cent. in October, the number of cases of labor troubles had decreased from 12 per cent. in May to less than 2 per cent. in October. This may have been partly due to the work or fight legislation.

TABLE II. DISTRIBUTION OF PRODUCT

	Number of Employees	
U. S. Government	41,721—68%	58,643—82%
Allied	10,396—17%	7,086—9%
Miscellaneous	7,732—12.6%	5,284—8%
Stock	1,495—2.4%	890—1%
Total	560,985—100%	71,903—100%
Firms reporting source of orders	231—60,985 Emp.	350—71,903 Emp.

The purchase of machine tools by our Allies was made through the purchasing commission, and where these purchases were made through a loan to the government desiring the tools, negotiations were in many cases made by the Machine-Tool Section with the manufacturer of the machine desired. In all such cases the price paid was subject to approval by the Machine-Tool Section, as we had agreed to purchase machine tools for our Allies at the same price we paid for them. In most cases, however, they were permitted to place their orders as they pleased, subject, of course, to the approval of the Machine-Tool Section of the War Industries Board.

During the year ending Sept. 1, 1918, the purchases through the purchasing commission were as follows:

For the French government	$2,970,435.00
For the British government	7,636,086.00
For the Italian government	1,764,302.00
For the Belgian government	26,126.00
For the Russian government	61,186.00

The total exports of machine tools to the allied countries from February until October, 1918, follow: Based

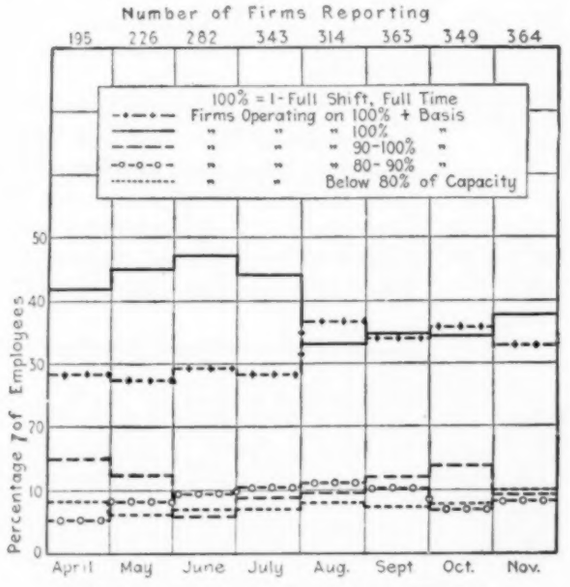


FIG. 2. FULL TIME AND OVERTIME

on these figures, the total annual export for 12 months would amount to approximately 83,000 tons, having a total value of $50,000,000:

	Weight in Pounds	Value
France	33,685,109	$10,624,923.00
Italy	7,678,343	2,179,026.00
Portugal	32,596	13,621.00
England	28,584,630	11,137,697.00
Japan	17,268,365	3,398,277.00
Russia	31,020	9,831.00
All other countries	31,934,893	7,679,996.00

During the month of July, a survey was made of the material likely to be required by the machine-tool industry for the six months ending Dec. 31, as this would also serve as a guide for future requirements had the war lasted. Table III has been compiled as showing the material which would be required by the machine-tool industry and the manufacturers of metal-

TABLE III. REQUIREMENTS OF MACHINE-TOOL INDUSTRY

Average demand of power from central stations	292,892 kw.
Coal required for heat and power (not including central stations)	802,629 tons
Iron castings required (50% scrap)	917,366 tons
Pig iron	489,683 tons
Foundry coke	351,650 tons
Steel forgings	43,392 tons
Screw stock	44,210 tons
Black stock	91,567 tons
Ground stock	5,778 tons
Carbon tool steel	10,542 tons
High-speed tool steel	2,083 tons
Steel castings	57,429 tons
Bronze castings	10,720 tons

working machinery for a period from July, 1918, to July, 1919.

According to the statistics which were secured, there were 310 firms engaged in the production of metal-working machinery in the United States in July, 1914. These employed 30,082 people and had an annual output of approximately $50,000,000.

In April, 1917, the number of firms had increased to 367 and the number of employees to 67,229. In October, 1918, the number of plants was 378 and the number of employees, 77,154.

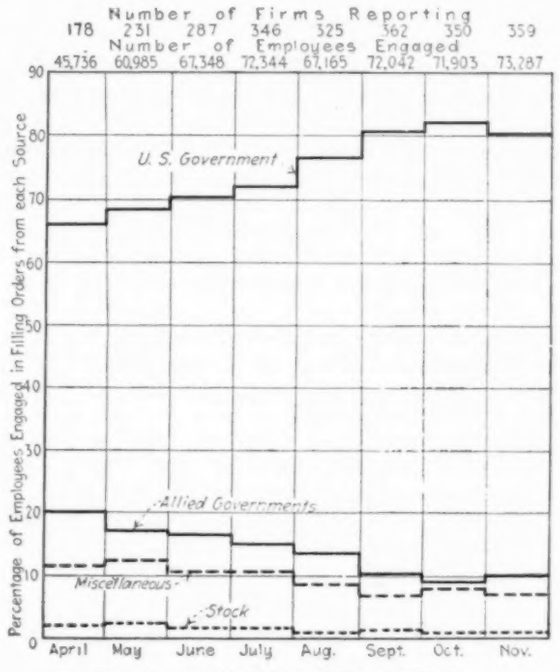

Number of Firms Reporting
178 231 287 346 325 362 350 359
Number of Employees Engaged
45,736 60,985 67,348 72,344 67,165 72,042 71,903 73,287
Percentage of Employees Engaged in Filling Orders from each Source
U. S. Government
Allied Governments
Miscellaneous
Stock
April May June July Aug. Sept. Oct. Nov.

FIG. 3. NUMBER OF EMPLOYEES

These figures do not in most cases include those plants which made only a few tools on contract for the regular manufacturers, nor those who engaged temporarily in the production of metal-working machinery but who have since gone into other lines of work. It is believed, however, that had firms of this kind been included it would not have increased the total by more than 5 per cent. in either case.

It is extremely interesting to learn that, according to all records, the industry had been sufficiently expanded so that, when hostilities ceased, it had a yearly capacity of turning out 1,000,000 tons of metal-working machinery with an estimated value of $500,000,000. In contrast with this, we are informed that the German Empire during 1917 is supposed to have produced $200,000,000 worth of metal-working machinery, while the British output is given at $50,000,000.

Table IV gives an idea of the distribution and location of the metal-working plants by states and also the number of men employed in each. This gives a good idea of the distribution of the machine-building industry and leaves no doubt as to the predominance of Ohio in this line, as it shows more than any other two states combined. According to its size and population, however, Rhode Island holds the palm, with a total of 6382 employees. The map shows distribution by cities.

The accompanying map in the form of a double page insert, however, gives a good idea of the distribution of both the firms and the men in all the states where metal-working machinery is of sufficient size to warrant it being noted.

TABLE IV. METAL-WORKING MACHINERY MADE IN U. S.

	July, 1914	April, 1917	Oct., 1918
No. of firms	310	367	378
No. of employees	30,082	67,299	77,154
Yearly value of product	$50,000,000	.....	$500,000,000
No. of Employees by States:			
California	0	25	30
Connecticut	3,425	7,897	9,363
Delaware	221	318	328
Illinois	1,564	3,680	4,201
Indiana	450	1,940	2,145
Iowa	68	273	448
Kentucky	191	417	585
Maine	250	450	405
Maryland	200	200	210
Massachusetts	2,865	7,192	8,111
Michigan	593	1,737	2,065
Missouri	58	115	140
New Hampshire	117	254	222
New Jersey	1,017	2,206	2,488
New York	3,430	5,897	6,880
Ohio	7,855	19,048	20,895
Pennsylvania	3,212	6,202	6,467
Rhode Island	2,698	4,354	6,382
Tennessee	5	10	15
Vermont	893	2,315	2,276
Virginia	20	40	155
Wisconsin	950	2,729	3,363
	30,082	67,299	77,174

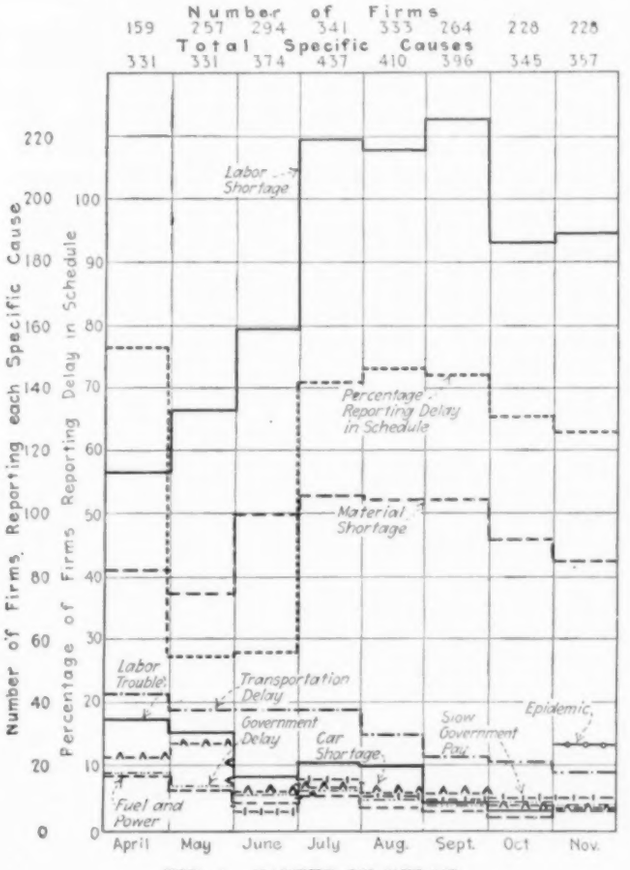

Number of Firms
159 257 294 341 333 264 228 225
Total Specific Causes
331 331 374 437 410 396 345 357
Number of Firms Reporting each Specific Cause
Percentage of Firms Reporting Delay in Schedule
Labor Shortage
Percentage Reporting Delay in Schedule
Material Shortage
Labor Trouble
Transportation Delay
Government Delay
Car Shortage
Slow Government Pay
Epidemic
Fuel and Power
April May June July Aug. Sept. Oct Nov.

FIG. 4. CAUSES OF DELAY

How to Prevent a Grinding Trouble

BY RICHARD J. JACKER

On page 705 of *American Machinist*, John Vernon wants to know how to grind one side of a ¼-in. cold-rolled steel plate 2½ in. wide and 12 in. long without having it warp. I would suggest grinding both sides of the plate before riveting on the cast-iron bracket, and then grinding the side opposite to the desired finish.

A Course in Industrial Engineering

By F. A. Hobart

Instructor of Machine Shop Practice and Management, University of Illinois

The need for men who have had specific training in Industrial engineering, which is purely an arbitrary title, has been long felt. At the present time some of the leading universities are offering pioneer courses in scientific management and its allied branches. These courses are offered, as a rule, in connection with the regular commercial or business courses and have an affiliation with the engineering departments in so far as the fundamental general engineering and shop courses are concerned.

At the present time, however, the teaching of industrial engineering is largely of an experimental nature. The courses as outlined in the curricula are liable to be more attractive and flattering than efficient but the general aim is to produce graduates who will be able to apply the fundamental principles of scientific management and to obtain maximum production in a manner peculiar to the shop in question.

It is an accepted fact that the true industrial engineer must understand, primarily, methods, material, markets and men, as they apply directly to manufacturing problems. The student who contemplates following the profession of a manufacturing expert must possess, as part of his natural equipment of initiative and practical ability, a fair working knowledge of the four factors mentioned above.

Let us, therefore, analyze two plans of teaching industrial engineering now in use, and for comparison consider a third plan.

(A) A Lecture Course Without Shop Practice

This plan is of use to institutions without shops in which to give practical demonstrations of the principles of shop management and which are not fortunate in having the available funds necessary to do otherwise.

(B) A Course of Intensified Shop Practice

In this plan the shops of the institution are organized according to the principles of efficient management. A standard machine is designed and manufactured for the purpose of giving its readers actual shop practice and demonstrations in the principles of management involved. This work is supplemented by related lectures. To assure each member of the class actual contact with the various managerial duties the class is divided into groups. These groups are assigned to certain divisions of the work so that each student will cover every detail of the office and shop routine employed in manufacturing the machine. Inasmuch as over 80 per cent. of freshmen students know little or nothing of modern manufacturing methods the practicability of this procedure is obvious.

(C) A Demonstrative Course

This plan attempts to acquaint the students with a general knowledge of practical shop work and the functions of shop management. The course includes a semester of elementary shop practice together with lectures pertaining to the same, and a semester of advanced shop practice and the manufacturing of a standard machine, with preliminary lectures on shop management. These courses are prerequisites to a third course on the application of the principles of scientific management.

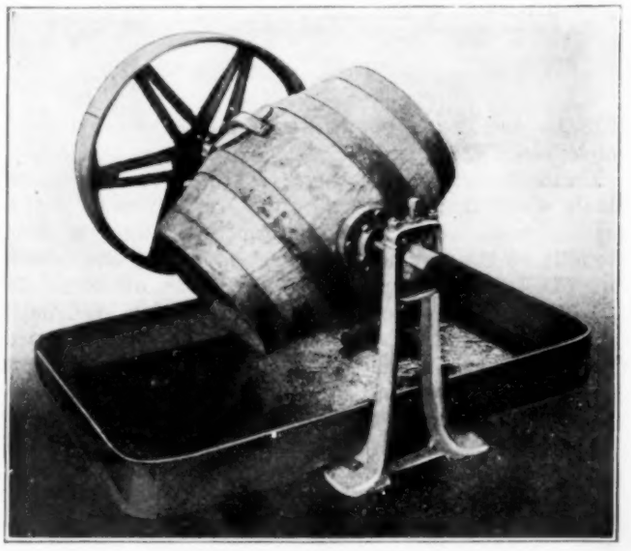
This method permits instruction in the care and operation of machine tools and in preparing the sequence of operations to be followed in working out assigned problems. It also allows a better understanding of instruction cards. This seems to be the logical procedure to follow. The manufacturing of a standard machine is done by the students of the first two courses under the supervision of students of the third who have advanced from the shops to engineering duties in managerial capacities. It can be readily seen that a course of this kind covers the work in as thorough a manner as is possible in educational institutions.

In teaching industrial engineering according to plan (B) it seems that shop practice is necessarily presented for production purposes alone without any relation to allied subjects such as general engineering and applied mechanics. In other words, the work is quite similar to that of trade schools. All the objectionable features of plans (A) and (B) are removed in (C) as the work may be presented in such a manner as to be directly correlated with regular engineering subjects.

A Cheap and Efficient Tumbling Barrel

By John Drew

A tumbling barrel, all parts of which except the central feature may be found in any machine shop, is shown in the cut. A pair of shaft hangers, two flange castings, two short pieces of shafting and a suitable pulley being the principal requirements. The barrel itself, while not exactly indigenous to the machine shop, will, after July 1, probably be a drug on the market.



A HOME-MADE TUMBLING BARREL

The construction is clearly shown by the picture. The floor pan, which is a necessity if the tumbling is to be done wet, may be soldered up from sheet metal if a cast-iron pan is not available as in this case, while if the tumbling is dry the pan may be omitted altogether. The opening in the side of the barrel will of course depend upon the nature of the material to be handled. In this one a swinging strap is attached by a bolt and hasp to the barrel, and a round cover fitted with a rubber gasket is held to the opening by a setscrew.

Making Water-Gage Fittings in a Railroad Shop

BY FRANK A. STANLEY

This article covers sets of tools for turning, boring, facing, threading and otherwise machining various parts entering into the construction of gage cocks and fittings. The tools are all used on the brass lathe, are of a practical character, and may be of value on similar kinds of work.

THE halftone and line engravings illustrate complete sets of brass lathe tools made and used at the Sacramento, Calif., shops of the Southern Pacific Co. for turning out water-gage cocks for all classes of locomotive boilers. These tools, like other equipment made specially for various classes of brass fittings, have effected an important saving compared with results obtained with earlier apparatus, and it is believed that details of the several tool outfits herein described will be of value to readers engaged in similar lines of shop work.

Figs. 1, 2 and 3 illustrate the various tools used for finishing the fittings for the water gage in Fig. 4. As the top and bottom fittings here shown are alike, except for the pipe connection at the bottom of the latter, only one of the fittings is included in the group of parts and tools in Fig. 1. The one shown is for holding the lower gage-glass stem and is seen at *A*, Fig. 1.

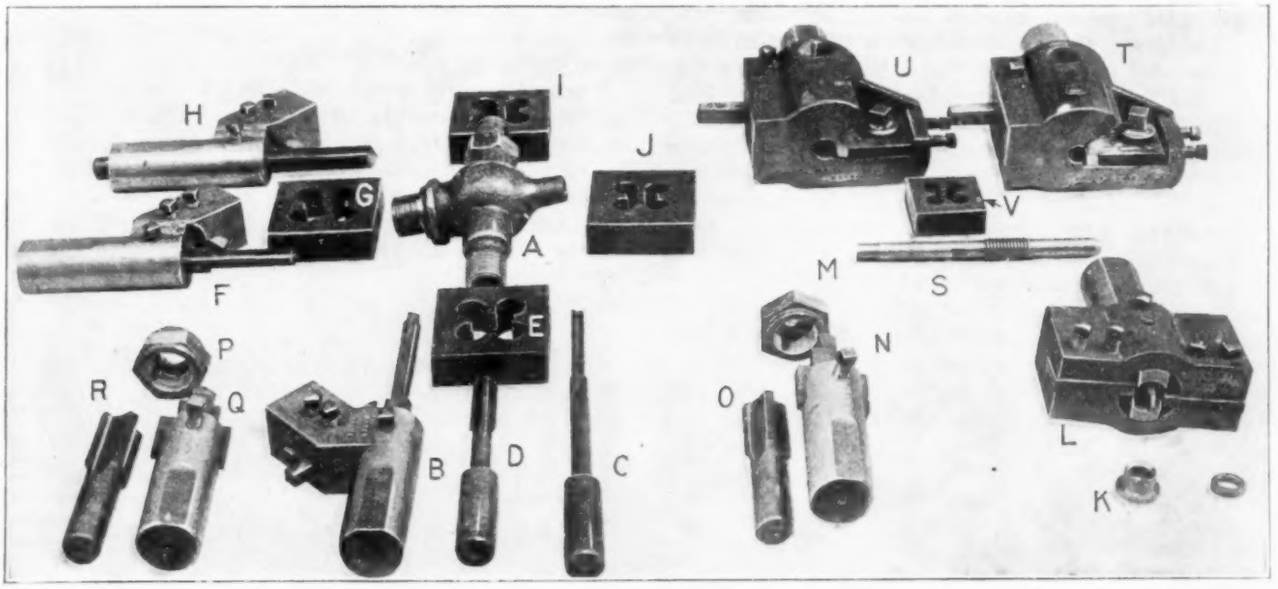


FIG. 1. GROUP OF TOOLS FOR GAGE FITTINGS

The tools for finishing the upper and lower valve seats and valve-packing nipple are represented at *B*, *C* and *D*, Figs. 1 and 2. The combination box tool and drill at *B* starts the $\frac{3}{8}$-in. hole for the passage under the valve seat, drills the $\frac{1}{2}$-in. hole for the valve stem, drills the $\frac{3}{4}$-in. hole in the nipple for the reception of the packing gland, turns the outside of that nipple to $1\frac{1}{8}$-in. diameter for the threading for the valve-seat packing cap and finishes and rounds over the end of the nipple, all at one operation. The drill carried in the tool *B* has three diameters, the shoulder from the outer or $\frac{3}{8}$-in. diameter to the $\frac{1}{2}$-in. portion being carried upon a radius of $\frac{1}{4}$ in. to rough out the seat in the valve for the spherical end of the valve stem which, as seen in Fig. 4, is finished to a semicircle of $\frac{1}{2}$-in. diameter. This seat in the valve and the $\frac{3}{8}$-in. hole forming the passage through the end of the same nipple are finished by means of the tool *C*, Figs. 1 and 2, which is guided by its $\frac{1}{2}$-in. body in the valve-stem hole drilled by the first tool *B*, and thus used for putting the $\frac{3}{8}$-in. hole clear through the outer nipple and at the same time finishing the $\frac{1}{2}$-in. seat for the valve. The tap *D* is then run in to tap the stem hole.

The turning cutter in the box tool *B*, Fig. 1, has already been referred to as sizing the outside of the valve-packing nipple for the threading for the packing cap. The surface thus turned is threaded with a $1\frac{1}{8}$-in. by 14-thread die *E*, Fig. 1.

The box tool at *F*, Figs. 1 and 2, is for finishing the nipple for holding the lower gage glass, and its work consists of drilling out the $\frac{1}{2}$-in. passage through the nipple into the valve chamber, enlarging the outer end of the hole to $\frac{11}{16}$ in. for a depth of $\frac{1}{2}$ in. to receive the end of the gage glass, turning the outside of the nipple to $1\frac{3}{16}$ in. for the threading for the packing nut and facing off the end of the nipple.

The arrangement of the tools in the box holder *F*,

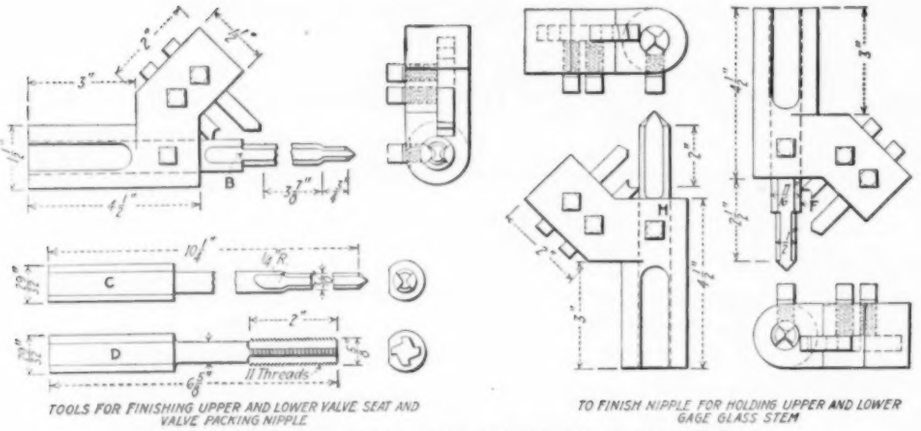

TOOLS FOR FINISHING UPPER AND LOWER VALVE SEAT AND VALVE PACKING NIPPLE
TO FINISH NIPPLE FOR HOLDING UPPER AND LOWER GAGE GLASS STEM

FIG. 2. DETAILS OF TOOLS FOR FINISHING VALVE BODIES

Figs. 1 and 2, is similar to that at *B* already described. As in that instance, the inserted cutters are so placed as to admit of ready adjustment for the desired diameter.

The nipple body sized by the tool at *F* is threaded with the die at *G* to $1\frac{3}{16}$ by 12 threads per inch.

A similar type of tool is used for the corresponding nipple of the other fitting for the upper gage-glass stem, this tool being included at *H* to show one modification in the drill, which is in this case a straight $\frac{11}{16}$-in. tool to put a straight hole of that size in the upper fitting, as shown in Fig. 4. The thread on the outside of the fitting is also $1\frac{3}{16}$ in. by 12, and so the same die *G* is used as for the corresponding thread on the lower gage-glass nipple.

On both lower and upper gage-cock bodies there is a taper-threaded nipple measuring 1 in. outside diameter at the small end and having a taper of $1\frac{1}{2}$ in. per foot. This thread is cut with the die *I*, Fig. 1.

The lower gage cock has also a nipple at the bottom for a standard $\frac{1}{2}$-in. pipe connection, 14 threads per inch, which is run on with the die *J*.

The packing gland for the valve is shown at *K*, Figs. 1 and 4. It is $\frac{3}{4}$ in. in diameter in the body, $\frac{5}{8}$ in. long over all, and has a flange 1 in. in diameter by $\frac{1}{8}$ in. wide. It is machined by the turret tool *L*, Figs. 1 and 3. The two inserted cutters in this box tool turn the body to size and face the end and the under side of the flange or head. The work as turned to diameter runs in the open, case-hardened guide *a*, Fig. 3, which is cut away at the sides, leaving bearing surfaces $\frac{3}{8}$ in. wide at opposite sides, as indicated in the drawing. The interior of the gland is bored out to $\frac{1}{2}$ in. in diameter by the flat drill or reamer *b* whose shank is secured in the box tool. The same tool *b* also forms out the bevel countersink in the mouth of the gland to the desired angle. The valve-seat packing cap *M* Figs. 1 and 4, is bored out and threaded to $1\frac{1}{8}$ by 14 threads for a depth of $\frac{3}{4}$ in., the closed end of the cap being bored to $\frac{1}{2}$ in. for the admission of the valve stem. The tool for boring for both sizes from one end of the cap is shown at *N*, Figs. 1 and 3. The reamer diameter for the tapping size is given as $1\frac{3}{64}$ in. to be followed by the $1\frac{1}{8}$-in. tap *O*. The reamer or flat cutter also faces off the open end of the cap and thus brings it to length. A similar tool is used for the gage-stem packing cap *P* which has an internal thread $1\frac{3}{16}$ in. by 12 threads per inch, and a hole for clearing the gage glass $\frac{11}{16}$ in. in diameter through the bottom of the cap. The reamer or boring cutter is represented at *Q* and the tap for the internal thread at *R*.

Valve-Stem Tools

The valve stem, like all other parts described, is of brass, and it is shown in place in Fig. 4 at *S*. For the greater portion of its length it is $\frac{1}{2}$ in. in diameter, but near the middle there is a portion $1\frac{1}{4}$ in. long which is $\frac{3}{8}$ in. threaded 11 per inch. This stem is also shown in Fig. 1, where it is seen at *S*. This view also shows the round end, which has a radius of $\frac{1}{4}$ inch.

The valve stem is machined in two operations from opposite ends by the box tools *T* and *U*, Figs. 1 and 3. The first of these turns the long plain end, while at the same cut an inserted tool near the rear of the box reduces the end of the stem to a diameter of $\frac{3}{8}$ in. for the fit in the hand knob.

When the work is reversed and the second tool *U* applied the other end is turned to size and the enlarged central portion turned for threading. At the same time the rounded end is finished to the radius required by the formed tool inserted at the rear of box *U*. The character of the turning and end-forming cutters in both box tools is shown by the drawing. The threading

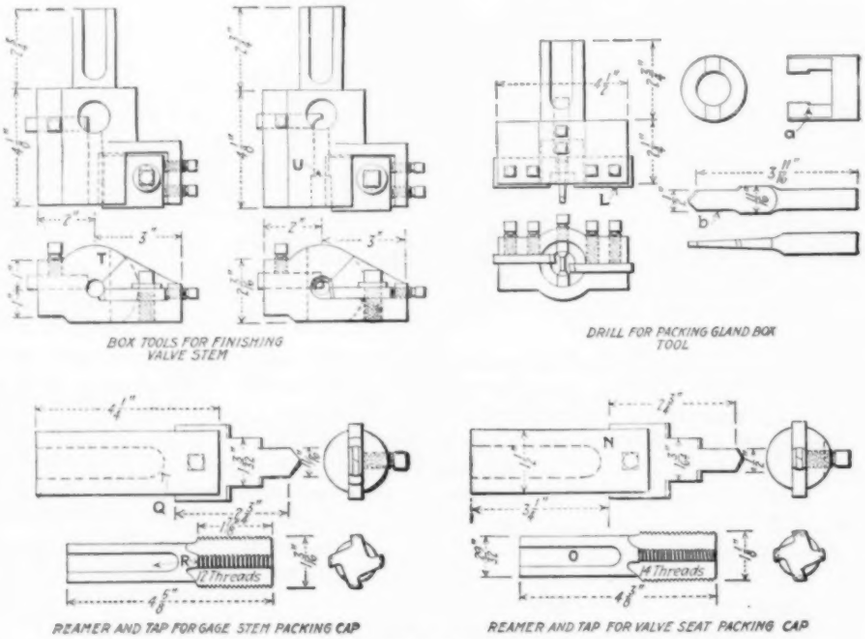
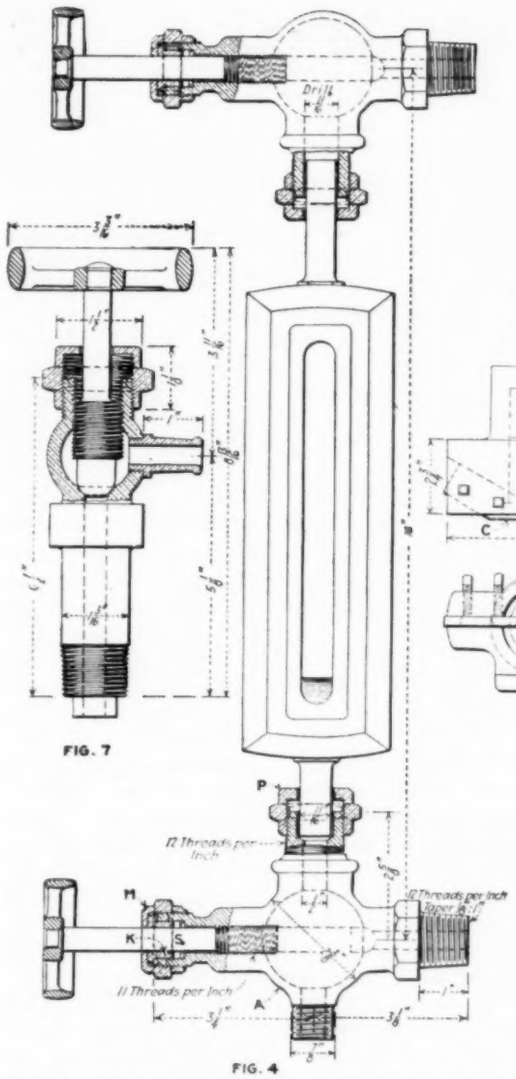

BOX TOOLS FOR FINISHING VALVE STEM
DRILL FOR PACKING GLAND BOX TOOL
REAMER AND TAP FOR GAGE STEM PACKING CAP
REAMER AND TAP FOR VALVE SEAT PACKING CAP

FIG. 3. DETAILS OF TOOLS FOR FINISHING FITTINGS



FIGS. 4 AND 7. THE GAGE FITTINGS IN PLACE AND THE ASSEMBLY OF GAGE

of the body of the valve stem is accomplished by the die *V*.

Figs. 5 and 6 should be of interest here, as they show another set of tools for a somewhat different style of gage cock in which a shorter valve stem is used and one with much larger thread and valve end. Details of the parts of this cock are given in Fig. 7. The stem is only 4⅛ in. long over all, while the threaded portion is ⅞ in. in diameter and the round end 1 1/16 in. in diameter with a radius of 9/16 inch.

The gage-cock body is shown at *A*, Fig. 5. At *B*, Figs. 5 and 6, is the tool for turning the end for threading and for boring the valve-stem opening. The tap for threading the hole to receive the threaded portion of the valve stem is shown in the line drawing at *C*, Fig. 6.

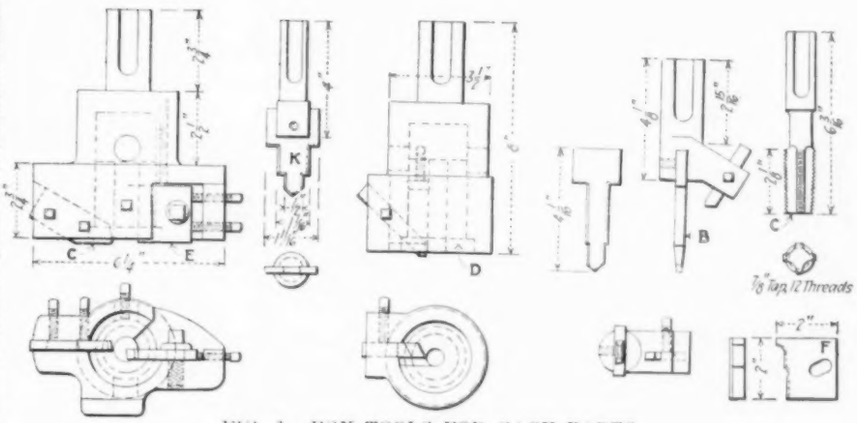


FIG. 6. BOX TOOLS FOR GAGE PARTS

The box tool for turning the long, plain end of the stem is shown at *D*, Figs. 5 and 6. This carries a guide bushing with a ½-in. hole and a tool at the outer end for turning the stem size as well as a tool at the rear of the guide bushing for reducing the end of the stem to ⅜ in. for the fit in the hand knob.

The Turning Tool

The box tool *E* is for the larger end and turns the body size for threading to ⅞ in. at the same cut, forming the spherical end for the valve to a radius of 9/16 in. The turning tool for this cut is shown at *F* and is a formed cutter which establishes the two diameters referred to, being preceded in its cut along the large diameter by the opposite tool *G* in the holder which is placed at the usual angle to permit of adjustment.

The dies for the stem and for the pipe connection are at *H* and *I* respectively.

The finishing of the gland cap *J* consists in boring out to 1 1/16 in. for the tapping size and boring the closed end to ½ in. with the flat cutter *K*, then following with the tap *L*.

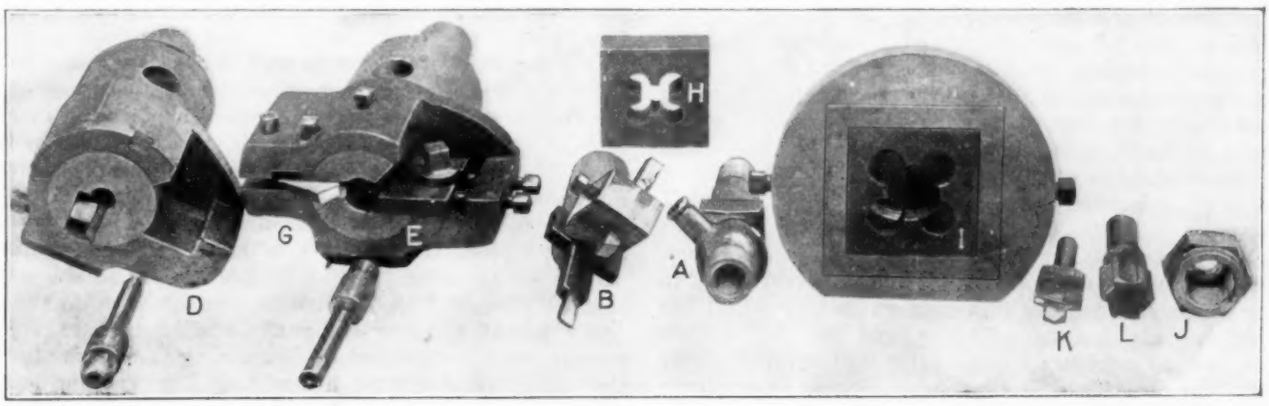


FIG. 5. ANOTHER GROUP OF GAGE-FITTING TOOLS

The Riddle of Dependency—I

By CHESLA C. SHERLOCK

ONCE a workman is injured and it is determined that the employer is liable for the payment of compensation under the workmen's compensation acts, a multitude of legal questions arise, or may arise, which in no small degree affect the employer's liability.

We have found in previous discussions that the payment of compensation to an injured workman, once it becomes due, is a comparatively simple matter. But if the workman dies as a result of his injuries, or is killed outright by the accident, then a whole mass of situations may grow out of the death, all of which are alive with a complexity of questions affecting the employer in his legal liability.

It is not proposed to make the question of dependency appear in an unnatural and distorted light, but it does involve many problems which, if not solved properly, may cause the employer no end of trouble and loss. Therefore the matter is here discussed fully in order that employers may have complete general information upon the subject.

As we have already noted, the primary purpose of the workmen's compensation acts was to cause industry to share a workman's loss with him in case of accidental injury. It is in no sense the purpose of the compensation acts to provide damages or indemnity. A workman who is protected by a compensation insurance policy, whether that policy be issued by the state or by private companies, is not justified in assuming that he is protected to the extent that a life insurance policy would afford protection, or that his dependents are in the relation of beneficiaries under that policy.

There is no such term as "beneficiary" under the workmen's compensation acts, but we do have a term which may be said loosely to correspond to it and that term is "dependency." But there is a vast difference between the two, and it is because so many people hold to the opinion that the two are the same that such a thorough understanding of the compensation principle of dependency is necessary.

No employer insures the life of a workman when he pays the premium on his compensation policy. Nor does the claim which the injured workman had under that policy for loss of earnings accrue to his estate upon his death, unless it can be proved that there was a dependency resting upon the deceased in favor of some other person, conforming to the law. If such a dependency exists, then the liability of the employer will extend to such person, even though the workman may himself be dead and the law makes references to the employer's liability in a way which infers that the liability ends at death. This is true, but the survival value of the workman's claim after death rests entirely upon the question of dependency. Hence, an employer is in a very difficult situation in many cases, especially when he has no way of knowing the facts in the case or the law upon such facts as he does know.

As a rule, the statutes are very careful to enumerate just what persons may be deemed to have been dependent upon a deceased workman, but they have been very lax in establishing a standard of dependency, so that it can be said that while there is such a thing as dependency under the acts, there is no fixed standard of dependency. The matter has largely been the result of the growth of judicial decisions touching upon the question from cases actually arising. Even then, there can be no doubt but that actual fraud has been practiced upon the American employers time and again, because of this lack of a fixed standard. This is particularly true in cases where the alleged dependents were not living with the deceased at the time of his injury, or were aliens living in a foreign country.

The writer has seen numerous cases of this nature which will be explained later. It is only necessary to point out at this time that there is every reason for employers to be cautious in such instances. The mere fact that the alleged dependents were not living with the deceased at the time of his injury and death, should be sufficient to put the average employer upon his guard.

The real question in the first instance is to determine what dependency is. Most of the acts define it, or attempt to define it. If the state law under which the employer is operating defines dependency, it will of course be necessary for the employer to follow the interpretation placed upon the subject. While these statutory definitions vary more or less in wording, they are in their essential principles identical.

What Constitutes Dependency

How much must a workman contribute to the support of some one to make that person a dependent under the law? How often must payments be made? Must they be made regularly? There are dangers for both workmen and employers from a misunderstanding or ignorance of the laws and their interpretation, which might well be avoided by a little study of the subject.

Courts Agree on Definitions

If the employer cares to take the time to examine the decisions of the courts, he will find that they have quite generally sifted the matter down to a common basis, but that, while they may agree in definitions, they do not always agree in the practical application of those definitions.

In a general way it may be said that any person who looks to another for support, who depends upon another for the necessities of life for a person of his or her class or station in life, is a dependent. This does not mean that the measure of dependency will be the same in every case. In order to be entitled to compensation as a dependent, it is not necessary for the claimant to support himself if he is able to do so, or to so reduce his expenditures or "station in life" as to be able to support himself. An English case which is quite generally looked upon as being the leading case on the subject, said: "The test of dependency is not whether the family could support life without the contributions of the deceased, but whether they depended upon them

as part of that income or means of living." If the deceased workman was in the habit of contributing toward the support of the claimants and such contributions had been used in providing the necessities of life for them in their rank or station, then dependency existed.

The contributions might have been made under legal or moral obligation, or they might have been merely voluntary. The fact as to what motives were in the background which prompted the dead workman to divide his earnings with others is of small consequence in determining the question of dependency. If any contributions were made, however slight, then a dependency may be established and the employer held liable.

Employers very often strenuously object to the payment of compensation to certain dependents because they feel that such payments are unnecessary and beyond the spirit of the law. If an indulgent father supported, or aided in supporting a minor son, who had earnings of his own, in a station slightly beyond what the average father would consider necessary, there is sufficient reason in the mind of the employer as to why he should deny compensation to such dependent.

The Spirit of the Acts

But while the law does not attempt to condone the mistakes of indulgent fathers, it is constantly necessary to recall to employers the spirit underlying the acts, which is that if industry deprives a workman of his earning power industry must share his loss with him. If industry cuts off the earning power entirely by killing the workman, then industry must share the loss with such persons as were, in fact, dependent upon such workman for support, or a portion of their support, at the time of the accident. Hence, the "riddle" of dependency.

Occasional gifts in the form of money to another do not establish dependency, and while a claimant cannot be compelled to reduce his expenditures in order to conform to his own earnings and income, he cannot collect compensation from the employer of the deceased workman merely to add to his own bank account or savings. If the money so received from the deceased workman was used in any other way than for support, there is no dependency under the law and no liability devolving upon the employer.

Some Typical Examples

In New York, it was held the dependency was established when the claimant was an unemployed school girl who was largely supported by the earnings of her brother, and the employer was obliged to pay compensation to her.

In a California case, a situation arose which clearly indicates the trend of the decisions upon the question of dependency. It was shown that the mother of the deceased workman had been receiving contributions from her son. She was at the time living with her husband, who was regularly employed, and with other sons who were earning money and contributing to her support. The court held that while it did not appear that the contributions of the deceased workman were necessary for her support, it did appear that they had been made, and that this fact made her a dependent entitled to compensation.

In another California case, however, a father of a deceased workman claimed dependency on the ground that he was a paralytic and unable to support himself. It was shown that the father had been receiving support from a lodge of which he was a member, and that he had received no contributions from his son for more than a year preceding the date of the accident. It was held that there was no dependency established.

And in another case arising in the same state, it was shown that the deceased workman had for several years supported his mother, but that for a few years immediately preceding his death he had discontinued such contributions, using them instead to pay for a small ranch to which he intended to bring his mother as soon as he had completed payments. It was held that there was no dependency.

Intention to Support Does Not Establish Dependency

In this connection it is well to note that a mere intention to provide support for another is not evidence of actual dependency in fact. Nor is dependency established by showing that irregular contributions were made. If it is clearly shown that no regular payments were made toward the support of the alleged dependent, the presumption is that such payments when made were in the nature of gifts rather than contributions toward support, and unless this presumption can be overcome there will be no dependency established.

Dependency does not depend upon the size of the contribution by any means. It may be, and very often is, of small amount, but the real test is whether it was made with sufficient regularity to establish that it was for support or to aid in the support of the claimant.

The moral obligation to support must not be confused with a legal obligation, or with actual evidence that support was rendered. It is not necessary that there be a legal or a moral obligation to support, as was pointed out previously, but while a moral obligation undoubtedly has some weight in establishing dependency, it is not sufficient to establish it without a fuller showing of facts.

The Michigan court, in this connection, said: "The claimant did not belong to the class conclusively presumed by the compensation law to be a dependent. On the date of the accident, it is conceded claimant was not dependent by reason of any support furnished her by the deceased. . . . A son is always under moral obligation to assist his indigent mother, but he is under no legal obligation to do so until proceedings under the statute have resulted in an order compelling him to do so. No such order was in force at the time of the accident; therefore . . . he was under no legal obligation at that time to support his mother."

In New York, the court has said that the death benefits under the act are not limited to those persons whom the deceased workman was legally charged to support, but that dependency includes those persons who were supported by the workman's voluntary contributions.

The mere fact that a deceased workman was a minor does not prevent his parents from being dependent upon him for support, in the opinion of the New York court.

In a Connecticut case, the court announced a test of dependency in the following words: "A dependent under the act is not necessarily one to whom the contributions of the injured or deceased workman are necessary to his or her support of life; the test is whether the contributions were relied upon by the dependent for his or her means of living, judging this by the class and position in life of the dependent. . . .

Partial dependency may exist though the contributions be at irregular intervals and in irregular amounts, and though the dependent had other means of support. . . . Dependency is thus in each case a fact to be determined."

Lord Halsbury, an English jurist, speaking of the question of dependency, said: "I decline to assume that the legislature has contemplated a particular 'standard' . . . dependent upon . . . the ordinary course of expenditure in the neighborhood and in the class in which the man lived . . . What the family was in fact earning, what the family was in fact spending for its maintenance as a family, seems to me to be the only thing which the judge could properly regard."

The Effect of English Opinions

It may be objected upon the part of American employers that English opinions are not American opinions and therefore may not express the spirit of the law here. But it should be kept in mind that our compensation acts are largely borrowed from the English acts, and that, therefore, English constructions of the English act are generally expressive of the construction which will be given to American acts.

In fact, the Massachusetts court has said, in this connection: "The exact words to be interpreted are to be found in the English Workmen's Compensation Act, and doubtless came thence into our own act. Therefore, the decisions of the English court before the adoption of our act are entitled to weight."

In the same connection, the Illinois court said: "The Illinois act is substantially adopted from the English acts of 1897 and 1906, and it will be presumed that the construction given to them by the English courts is to be applied to the Illinois act unless such construction is inconsistent with the spirit and policy of the laws of this state."

Similar constructions are to be found in the opinions of almost every American court, so that the policy has generally been accepted of looking to the decisions of the English courts for guidance in deciding compensation questions which are new under our own acts.

A Point of Difference Between English and American Acts

There is a distinction between the American and English acts, however, which must be kept in mind in order to obtain an intelligent view of these decisions. Under the English acts, the question of dependency is entirely a question of fact to be determined wholly from the circumstances surrounding each given case. This is not altogether true in the case of the American acts. Most of our statutes have inserted provisions declaring that certain persons were conclusively presumed to be wholly dependent upon the earnings of the deceased workman, and these persons are specifically enumerated by the various acts. Generally, however, they include the husband, the wife, children of a certain age, and incapacitated children.

There is slight doubt but that these provisions were placed in the American acts for the specific purpose of avoiding the English rule that dependency is always a case of fact, and for the purpose of establishing a status of presumed dependency for these persons so that compensation may be obtained by them as dependents from the employer without having to resort to the courts before having their status determined by a legal proceeding. There may be merit, and there doubtless is, in this policy, that is not for us to say, and employers who are confronted with the question of paying compensation to these persons as dependents cannot find refuge in English decisions, or for that matter the decisions of any court where such a presumed status is not declared, and thus avoid payment in their own state.

All that is necessary for persons falling within the classes enumerated to obtain compensation, is to prove that they are the husband, or the wife or any other person named in the statutory classification, and their case is then established and the employer must pay them the compensation due.

The purpose of this classification is doubtless to save time and litigation and to establish more definitely the employer's liability; to insure compensation to such dependent with the minimum expense and delay; and to prevent employers defrauding such persons or to prevent them from receiving the compensation by other means.

It should be remembered, however, that any person claiming compensation as a dependent who is not named in this classification does not have his right cut off, but that he stands in precisely the same position as all dependents do under the English act, namely, that the question of dependency in his case, is a question of fact to be established by the evidence.

We have found, then, that dependency means dependent for the ordinary necessities of life suitable for a person of the same class and position.

We have also found:

1. That the fact of the reliance of the claimant upon the deceased workman's contributions is sufficient evidence of a status of dependency.

2. That the reasonableness of the contribution or the motives prompting it on the part of the deceased workman cannot be assailed by the employer.

3. That dependency is not determined by a legal or a moral liability to furnish support, although it may be; that a mere voluntary contribution is sufficient to establish dependency provided the contributions were relied upon to furnish, or to aid in furnishing, the support.

4. That certain classes of persons are conclusively presumed to be dependents under the American acts and that the employer is absolutely bound to pay compensation to them.

5. That so far as other persons are concerned, their status is one of fact, to be established by proper evidence.

How to Prevent Oil from Discoloring Finished Surfaces

By Walter H. Webster

While Harry Senior's experience with the brown stain caused by oil on finished surfaces, narrated on page 886, corresponds with mine, I have found a great help in reducing the amount of elbow grease required.

Up to a few years ago this brown stain bothered me a great deal. Also the thick gum caused by a combination of oil and cast-iron dust seemed to defy everything but a scraper or emery cloth. In handling denatured alcohol it occurred to me to try it and the result was almost magical, although a certain amount of elbow grease was still required.

In using alcohol the protective coating is entirely removed and the surface is rendered particularly sensitive to the action of moisture and will rust in a very short time if the surface is allowed to remain unoiled.

Safety Practice in Power-Press Work

It is a well-known fact among persons familiar with the various forms of machine-shop work that the power press is responsible for a large percentage of accidents occurring in the machine shops. The following discussion and the illustrations of various types of guards are taken from a pamphlet on this subject recently published by the National Safety Council, Chicago, Illinois.

ACCIDENT records show that more injuries occur on power presses than on any other machine except perhaps the circular saw. This article will discuss especially the metal-working, or punch press, the use of which is so rapidly increasing; but many of the principles herein described can be applied with a little ingenuity to similar machines in specialty manufacturing, leather working, printing and binding, soap making and other industries.

Causes of Accidents

In practically all press accidents the operator's fingers are caught under the ram at the point of operation. This is due to (1) the press repeating, (2) the operator leaving his hand between the dies as the ram descends or (3) an unexpected stroke caused by accidental tripping.

The report of the Industrial Commission of Wisconsin for the year 1917 shows that of 343 punch-press accidents, 333 (or 97 per cent.) occurred at the working point, and that of 111 permanent injuries resulting from these accidents 110 (or over 99 per cent.) occurred at this point.

Over 99 per cent. of the cost of these accidents, including compensation and medical attention, was chargeable to accidents occurring at the point of operation. This is convincing proof that to prevent press accidents a study of the operation of each press must be made to eliminate if possible the need of the operator placing his hands between the dies, or, if this is impracticable, to install a guard which will prevent the operator's hands being caught between the dies when the ram descends.

The most effective way to remove the operating-point hazard is by using an automatic feed. It is difficult to develop a satisfactory feed for some operations, but if the problem can possibly be solved a marked increase in production (as well as safety) will result. Types of automatic feed include roll feed, plunger feed, chute feed, dial feed, revolving dies and sliding dies, which will be taken up in the foregoing order.

Roll Feed.—This may be used in most operations where strip metal is passed through the press for blanking. The rolls, driven by small gears or by a belt, feed the stock through the machine, and the operator's hands need not be placed between the dies. A press in use in the shops of the Felt & Tarrant Manufacturing Co., equipped with this type of feed, is shown in Fig. 17. As may be seen the material is taken from the roll at the left and travels across between the dies to the right side.

Plunger Feed.—The plunger pushes the work under the ram at each stroke, the operator placing the work in a vertical feed chute. The plunger operates at the bottom of the chute and the pieces are fed to the plunger by gravity.

Chute Feed.—The press is inclined, the material is placed in an inclined chute and slides under the ram

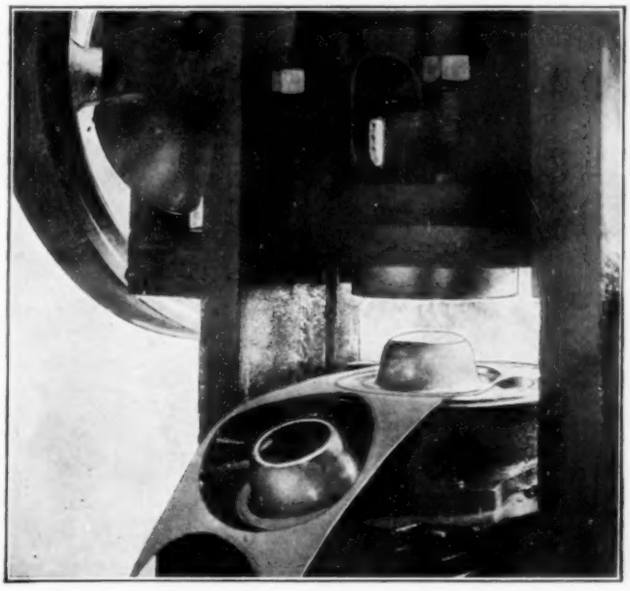


FIG. 1. BLANKING AND FORMING PANS IN ONE OPERATION

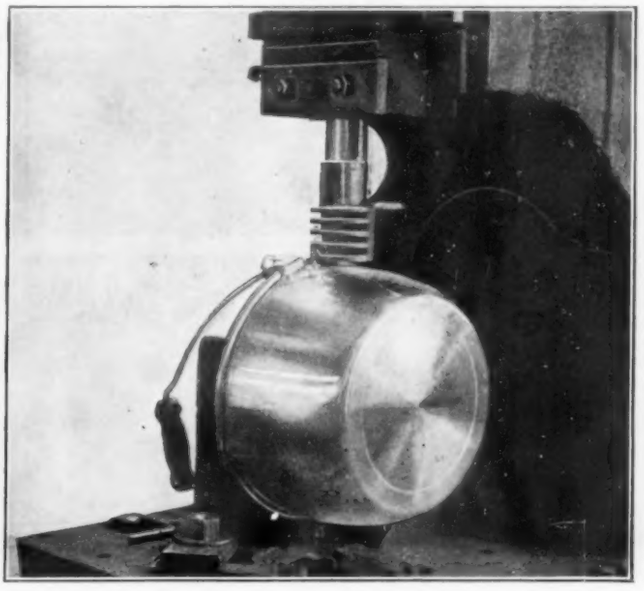
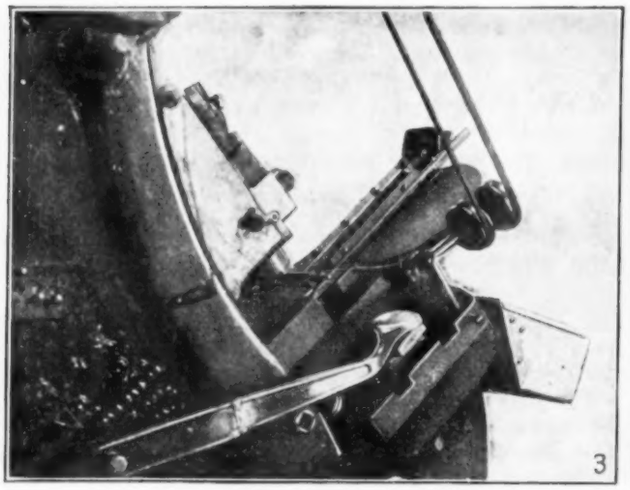
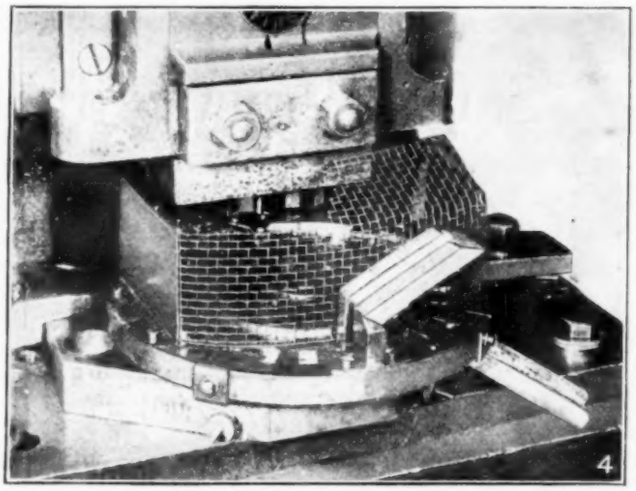
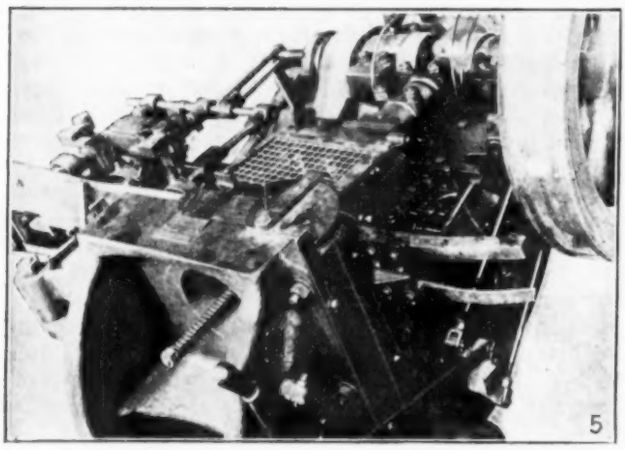
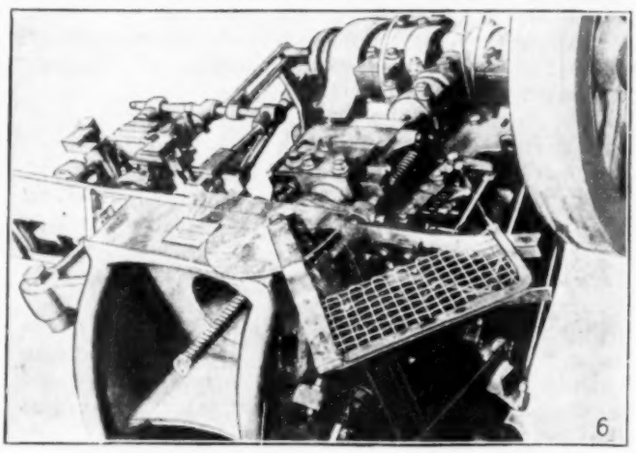


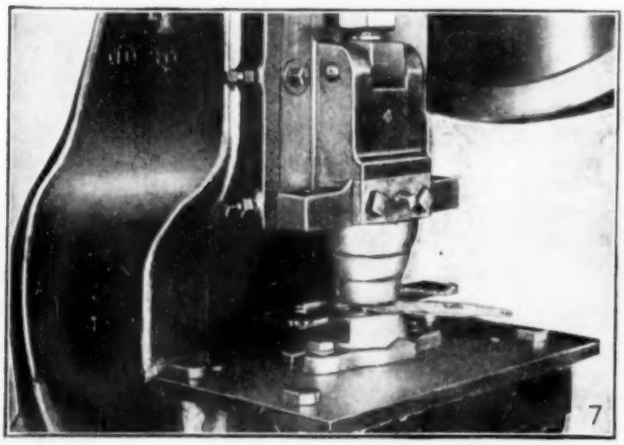
FIG. 2. RIVETING ON KETTLE HANDLES WITH A GUARDED DIE

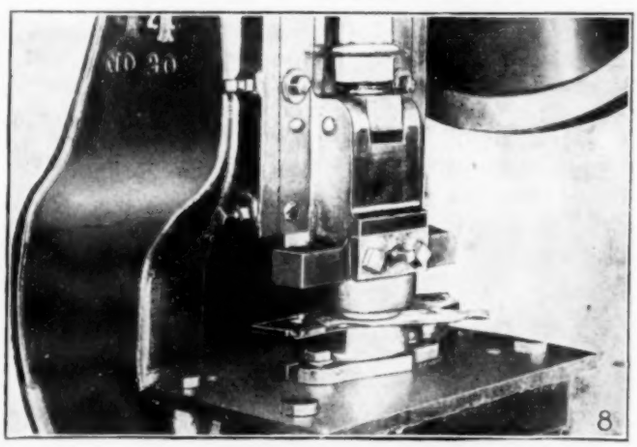


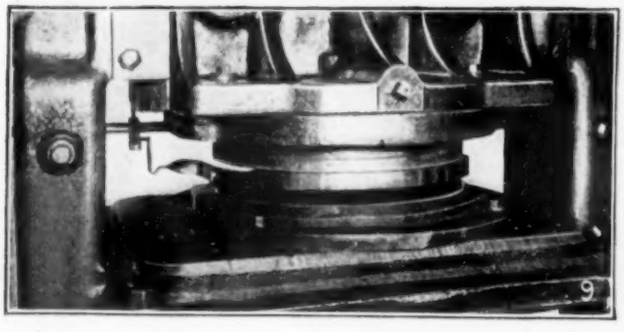


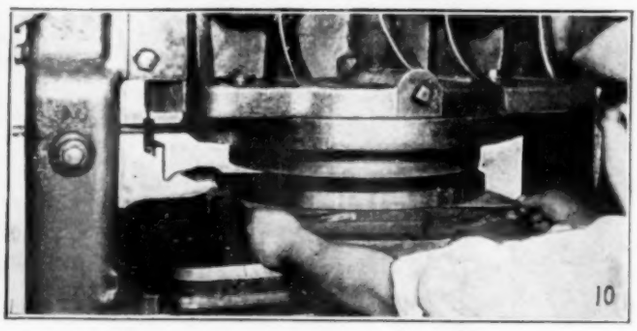












FIGS. 3 TO 10. VARIOUS SAFETY DEVICES

Fig. 3—A chute with dial feed for aluminum parts. Fig. 4—Revolving dies and a chute feed. Fig. 5—A locking device for a clutch operating lever. The guard is in place and locked by a rod connected to the operating lever. Fig. 6—Same as Fig. 5 except that the guard is out of position and the starting lever is locked. Figs 7 and 8—A telescopic guard with the ram up and down. Figs. 9 and 10—A finger-guard telltale. The metal strip is operated by the foot treadle and descends ahead of the ram.

by gravity. A press of this kind, in use in the shops of the American Pulley Co., is shown in Fig. 11. The work is placed in the track at *C*, the guard *D* preventing the operator from putting his hands in the die. The guard *E* prevents the operator's hands from being caught under the plunger, while the guard *F* prevents contact with the plunger itself. It will also be noticed that a guard *G* has been installed at the rear to prevent anything coming in contact with the dies from this side, and that the machine is equipped with a belt guard at *H*.

Dial Feed.—The work is carried under the descending ram by a revolving dial, fed by hand or by a gravity chute. The press shown in Fig. 3 is one of this type, in use in the shops of the Aluminum Goods Co. As the material is too light to slide down the chute by gravity a rotating disk was placed below the slide and the friction between this and the work helped to feed it to the dies. This operation was formerly done on a vertical power press with hand feed and many accidents resulted. It is stated by the company that this change resulted in a large increase in output and entire freedom from accident, as the operator's hands never come near the ram.

Revolving Dies.—Two or more dies are constructed on a plate which revolves at each stroke of the ram. The operator places the work in an empty die; when the die plate revolves it carries the work under the ram. Figs. 4 and 28 show two machines of this type. The one in Fig. 4 is in use at the plant of the Westinghouse Electric and Manufacturing Co. The pieces of work are placed in the upper chute, from whence they drop into the die, are carried into the plunger by the revolving die plate, and after being operated upon drop out through the chute shown at the lower right corner. The machine shown in Fig. 28 is one operated by the American Pulley Co. All plungers and dies are in the rear of the guard, and there is nothing in which the operator's hands can be caught.

Sliding Dies.—Each operation slides the die from under the ram. The operator loads the die, and with the down stroke the loaded die slides back into position. The principal hazards of an automatically fed machine occur when adjustments are being made or when the dies are being changed. If the plunger makes a stroke at such a time a serious injury may occur. Such machines should be equipped with an automatic stop which will lock the machine whenever continuous operation is interrupted. The plunger and dies should be inclosed if possible, to remove all danger of the operator's hand being caught. Figs. 5 and 6 show a press in use by the American Can Co., in which the act of moving the guard out of the way in order to make adjustment throws a clutch lock into action and prevents a stroke being made. The locking device itself is in the form of the sector of a circle attached to the guard and may be seen unlocked in Fig. 5 and locked in Fig. 6.

Blanking

In blanking operations, especially when hand fed, the plunger should be inclosed at the front and both sides by a guard of wire mesh, perforated metal or wired glass, leaving just enough space under guard to admit the stock. If of metal, the guard should contain a slot through which the operator can view his work. For hand feeding, this guard must fit the die closely; it should therefore be readjusted or a separate guard provided by the die maker or die setter whenever a new operation is put on the machine. A well-guarded gang press in use by the Westinghouse Electric and Manufacturing Co. is shown in Fig. 18. The guard consists of a horizontal bar fastened to the press and having mounted on it several sections of wire fencing, which can be slid along the bar to any desired position. The sheet of metal is inserted in the press underneath this fencing, which projects sufficiently low to prevent the fingers from following the piece too far in. The fencing may be hollowed out, as shown, to enable the fingers to go in as far as safety will permit.

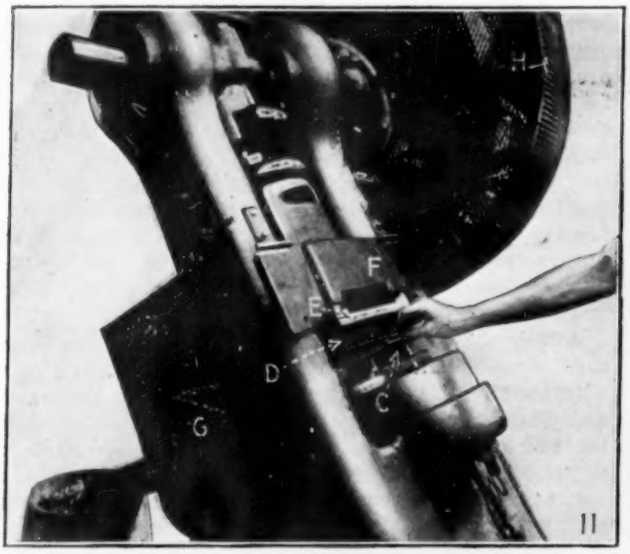
A telescopic guard attached to the ram is sometimes used in place of a basket inclosure. Figs. 7 and 8 show a device of this kind in use by the National Enameling and Stamping Co. The three telescopic sections are made of heavy sheet metal and cannot be raised by being struck with the operator's hand. The top section is easily removed from the ram to permit changing plungers when this operation is necessary. It is said to be a perfect guard for punching, as there is only space enough beneath the guard when the ram is up to admit the metal being punched.

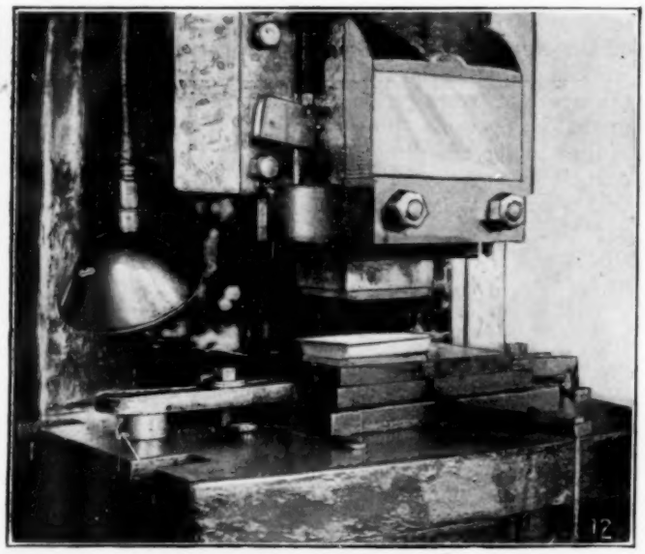
In large blanking operations using long sheets of metal the operator must ordinarily reach through the machine for the stock, unless a helper is stationed behind the machine. This hazard may be avoided and the speed of operation increased by the use of a vacuum pick-up controlled by the operator. A feeding device of this kind, in use by the Westinghouse Electric and Manufacturing Co., is shown in Figs. 13 and 14. Fig. 13 is a view taken at the rear of the press and shows the suction device picking up a single sheet and feeding it into the rear of the press, while Fig. 14 shows the two handles at the front, by means of which the operator manipulates the device. As may be seen the device consists of a sucker which moves on a specially shaped monorail at the back of the press and which is controlled by two long rods or handles extending through the press to the front. A valve in one of the handles enables the operator to open or close the suction. To operate, the handles are gripped at the front of the press and pushed as far back through the press as possible, this operation causing the sucker to drop on the top sheet on the pile of material. The valve is then opened, causing it to grip the top sheet when a forward motion of the handles pulls the sheet into position in the press. The valve is then closed and the sucker releases the sheet. A punching is then made, after which the sheet is drawn forward by the hand grasping the scrap projecting from the front of the press. With this device the helper is unnecessary.

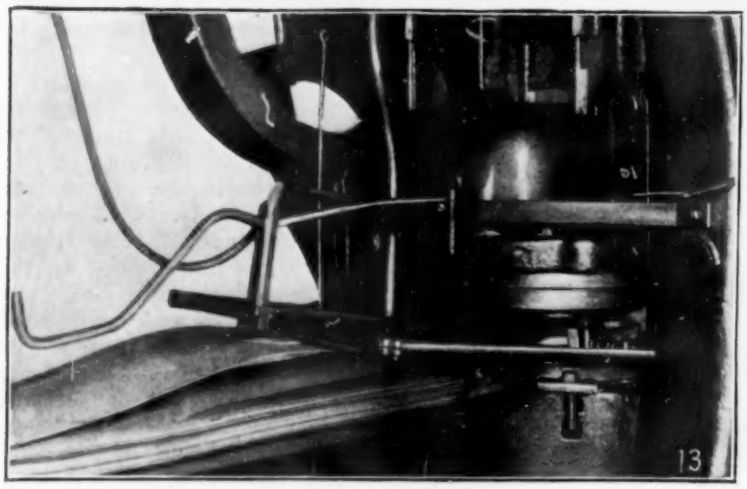
Forming

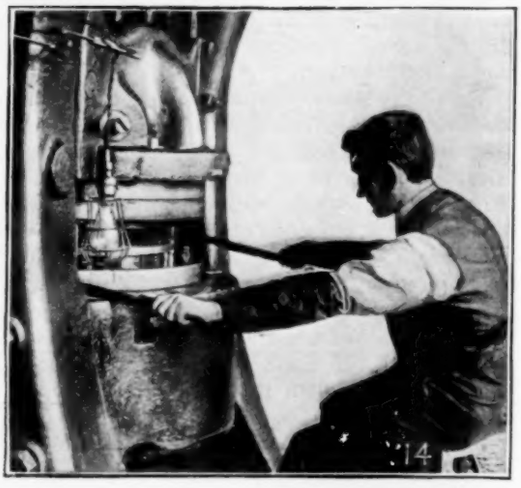
For many forming operations an automatic feed can be devised and the plunger inclosed. With hand feeding, a fixed-plunger inclosure is often impracticable. In such cases particular attention should be given to the design of dies, which will be taken up later, and in addition a device should be provided that will minimize the possibility of the operator's hand being left between dies.

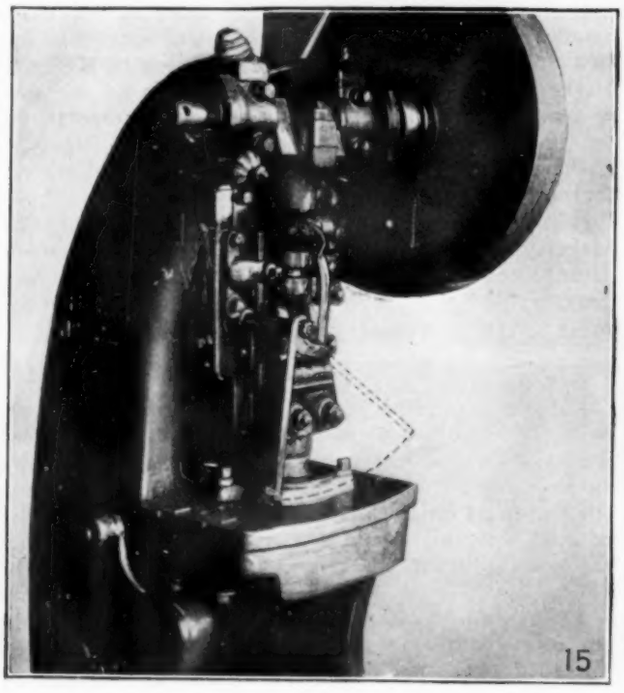
The safety devices for forming operations divide themselves naturally into a number of classes as follows: A sweep bar or gate; a swinging, sliding, dropping or expanding gate; a two-handed lever or push-button device; a telltale device; and tweezers, picks, air suckers or electromagnets.

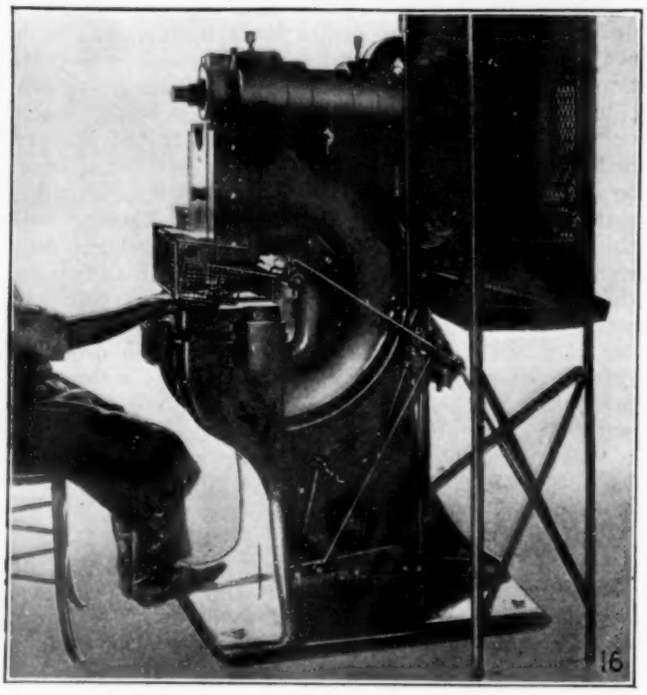












FIGS. 11 TO 16. FEEDING AND KICK-OUT DEVICES AND TWO TYPES OF GATES

Fig. 11—A gravity-chute feed. Fig. 12—A foot-operated kick-out device. Figs. 13 and 14—Rear and front views of a suction device for feeding sheet-metal strips. Fig. 15—A simple sweep guard. Fig. 16—A descending gate guard.

Sweep Bar or Gate.—A device of this kind swings across or moves upward in front of the dies or moves across the lower die as the ram descends, and thus pushes the hands out of danger. Such a guard should be operated by a movement of the ram, not by the treadle. A device of this kind in use on a press of the Simonds Manufacturing Co. is shown in Fig. 15. As the ram descends this swing moves from right to left across in front of the die, and pushes the operator's hand or hands out of the way if they happen to be near the ram. Another device for removing the operator's hands is shown in Figs. 26 and 27. This is used on an embossing press in the shops of the American Can Co.

Swinging, Sliding, Dropping or Expanding Gate.—A device of this kind forms a guard in front of the dies before the ram descends. This is operated by the treadle. If the operator's hand is in danger the gate cannot close and the treadle will not operate. A guard of this type in use by the Columbia Graphophone Co. is shown in Fig. 16. With this device in operation the pedal cannot put the press into action if the operator's hand is under the guard, which is of such size as to keep the operator away from the dies and ram.

Two-Handed Lever or Push-Button Device.—These require the use of both hands to trip the press or release the foot treadle. Where several men are employed at one large press an electric control may be arranged with push buttons in series, so each man must press two buttons (one with each hand) before the press will operate. The Ford Motor Co. employs such a press as may be seen in Fig. 24. This is a large sheet-metal press, and as may be seen each operator has to have both hands well up out of the way of the ram before the press can be operated. A two-hand, air-operated, tripping device used by the Worcester Pressed Steel Co. is shown in Fig. 25.

Telltale Device.—This warns the operator of the descending ram if his hands are in the danger zone. These are not positive in action because they do not remove the hands from between the dies. A device of this kind operated by the treadle and used by the American Can Co. is shown in Figs. 9 and 10.

Tweezers, Picks, Air Suckers or Electromagnets.—These may be used to place the material between the dies. The use of these hand feeders frequently increases the output as well as decreases the hazard.

Hand Pickers

Figs. 19 and 20 show four different styles of hand pickers used by the Westinghouse Electric and Manufacturing Co., Fig. 19 showing the pickers with the work attached and Fig. 20 the pickers alone. Figs. 21 and 23 show a pneumatic tool also used by the Westinghouse Electric and Manufacturing Co. Fig. 21 shows the front and back views of the bare tool, while Fig. 23 shows it in operation. This device was awarded a medal by the American Museum of Safety.

In removing stock from the press many accidents result from the workman's hands being caught and injured by another stroke of the press. In many operations the work is liable to adhere to the die, and a stripper or a kick-out device should be provided. A picker or compressed air may also be used to remove the work.

Blanking and forming are sometimes done in one stroke of the plunger, the cutting die blanking the piece and the forming die completing the operation. This double operation is often dangerous, unless special methods are used to decrease the hazard. Fig. 1 shows a good example of how the hazards can be overcome in an operation of this kind, the machine being in use in the shops of the Aluminum Goods Co., and the material being blanked out and made into a pan at one stroke of the press. These pans were formerly made in the reverse position, so that each one had to be removed from the die by hand with liability of accident. With the present arrangement, however, the operator does not have to place his hands under the press, but simply pulls the long sheet of material toward him and the pans fall out one after another in front of the machine. The company states that an increased output has been attained since the operation was changed over.

Most safeguards can be put out of use by the operator or can be wrongly adjusted so they will give little or no protection. Such types of guards are valueless unless they are kept in proper adjustment and the use of them strictly enforced.

Die Making

The safeguarding of presses should begin with the design of the dies. As much study should be given to the safety of the operator as to the mechanical efficiency. Safety in press operation can only be acquired by keeping the operator's hands out of the danger zone. Although mechanical safeguards are designed for this purpose, practically all types of guards may be rendered ineffective by the operator or by a slight error in adjustment. It is therefore essential to design the dies so that the operator need not put his hands between them. Many forming operations were originally done by putting each separate piece under the die by hand; but today, as a result of close study of die construction, we have sliding dies, revolving or dial dies, etc., all designed to prevent accidents to workmen and incidentally to increase production.

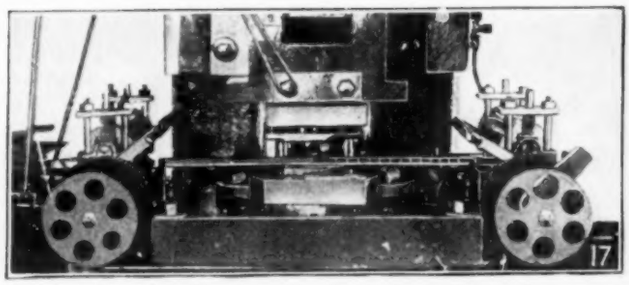
Even with hand feeding the hazard to the operator may often be reduced by cutting away superfluous metal from the die block, thus allowing more space for the fingers. Forethought on the part of the diemaker will often permit the operator to grasp the material by the sides instead of at the top and bottom.

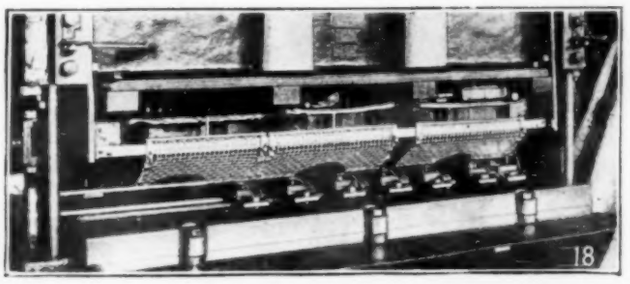
For some operations a guard can be attached to the die. This should be done wherever possible, as it insures that the guard will be properly placed and will protect the operator without interfering with his work.

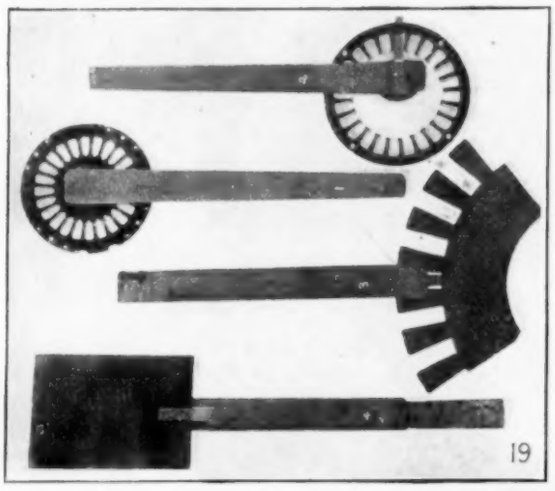
Dies of this kind for riveting the handles on aluminum kettles, in use by the Aluminum Goods Co. are shown in Figs. 2 and 22. Fig. 2 shows the device with a kettle in place, while Fig. 22 shows a number of the fixtures for various sized kettles. A guard is attached to each die, and it is impossible for the operator to place his fingers under the plunger. It will be noticed that a guard is attached to each set of dies in order to insure its always being in place no matter what size of kettle is being operated on.

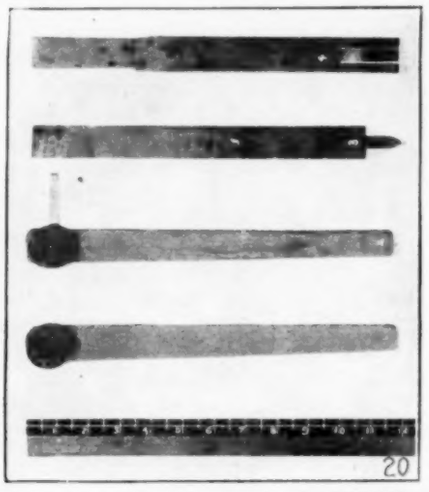
Repeating and Accidental Tripping

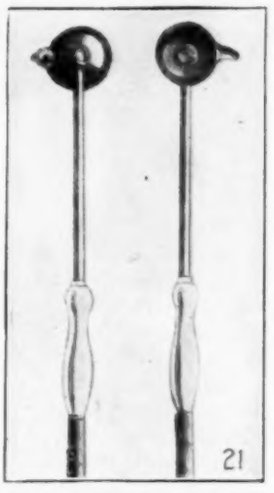
A large number of press accidents are caused by a repeat stroke of the ram catching the operator's hands under the die. Such accidents may often be prevented by a sweep or gate guard attached to the ram. Even if a guard is provided, however, every precaution should be taken to prevent unexpected strokes. These occur (1) because the operator does not remove his foot from the treadle at the conclusion of the stroke; (2) because the friction brake and guide strips are not properly

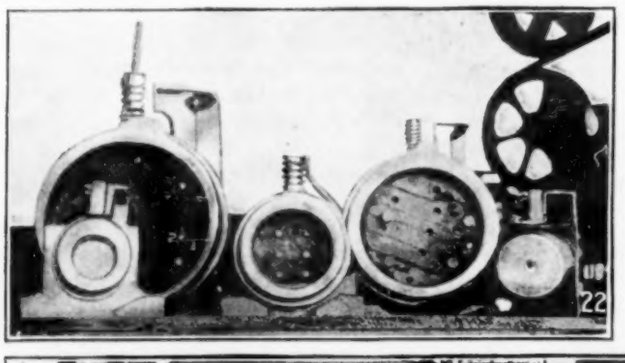


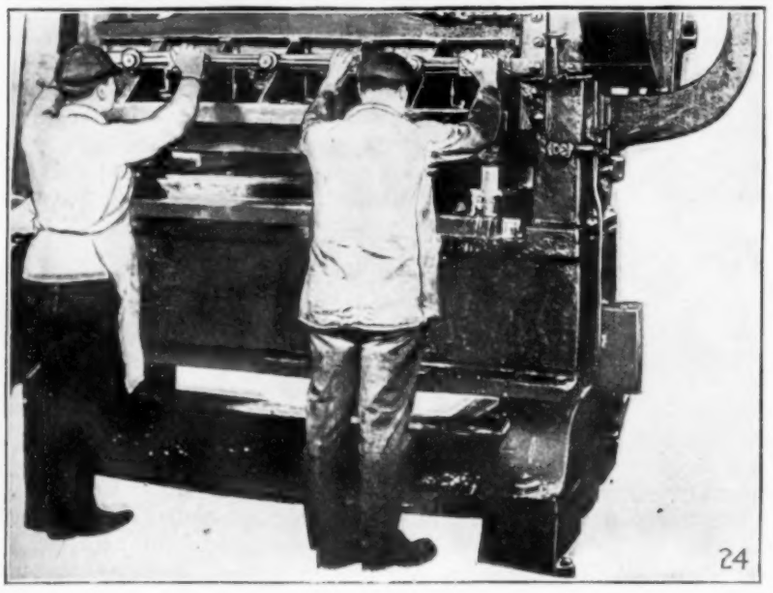


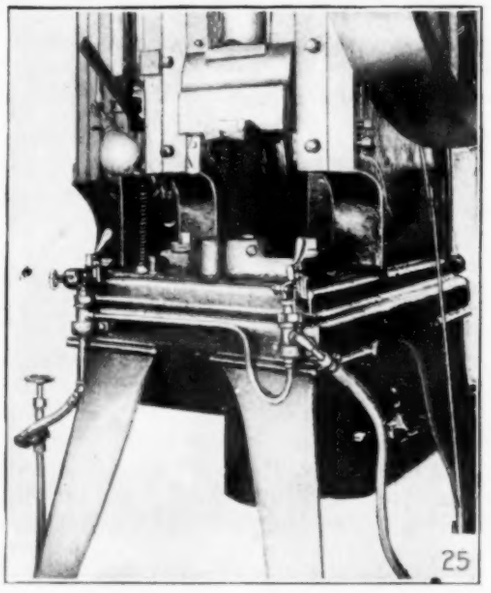






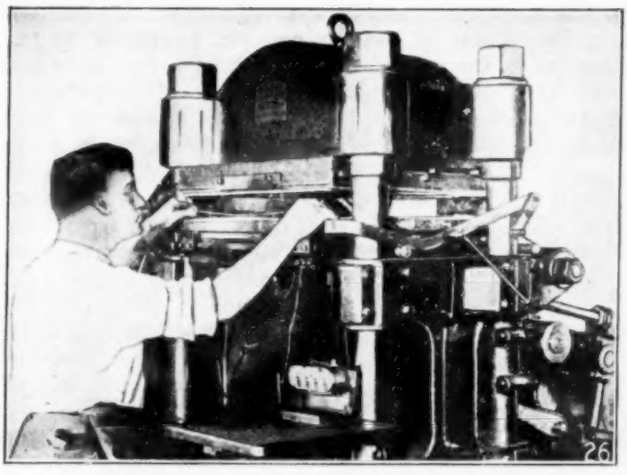


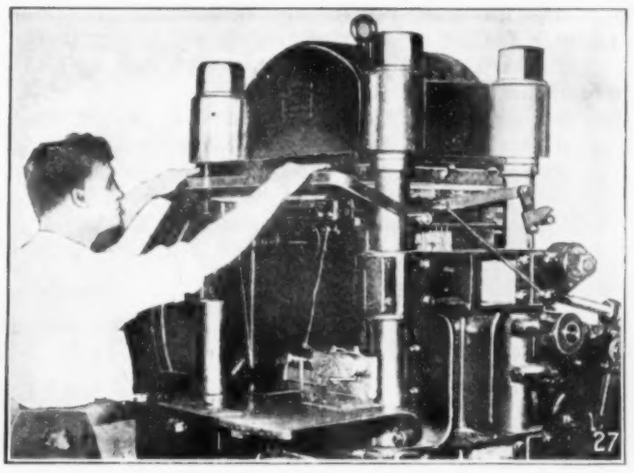




FIGS. 17 TO 25. DIFFERENT TYPES OF SAFETY AND FEEDING DEVICES

Fig. 17—Automatic roll feed for blanking from strip material. Fig. 18—A gang-press guard made of fencing material. Figs. 19 and 20—Hand pickers with and without the work attached. Fig. 21—A pneumatic work-removing tool. Fig. 22—Fixtures and dies for riveting kettle handles, as shown in Fig. 2. Fig. 23—Method of using the pneumatic tool shown in Fig. 21. Fig. 24—Electric control in which both hands of all the operators must be well away from the dies before the press is started. Fig. 25—A two-hand, air-operated, tripping device. Both handles must be raised at the same time to start the press.





FIGS. 26 AND 27. A SAFEGUARD FOR A STAMPING OR EMBOSSING PRESS THAT PUSHES THE OPERATOR'S HANDS AWAY FROM THE RAM BEFORE IT OPERATES

adjusted, or (3) by the breaking of a spring or other defect in the clutch mechanism.

Because of the monotony of power-press work it is easy for the operator to let his attention wander and fail to remove his foot from the treadle at the proper instant. It is therefore much better to have the press operated or controlled by one or two hand levers or buttons and not solely by a foot treadle. If the latter is used, a treadle disconnecting device should be provided which will require the treadle to be raised after each stroke.

The brake band, because of constant use, is subject to excessive wear, and unless it is kept in proper adjustment a repeat stroke is liable to occur. The guide strips, or gibs, should be set sufficiently tight to prevent rapid falling of the ram if the brake band breaks. Gumming of oil or lack of oil may cause the pulley to seize the shaft, resulting in a repeat stroke. If the clutch spring breaks or the end of latch becomes worn the same result may follow. To eliminate these hazards a nonrepeat device or a mechanical stop should be provided on all hand-fed presses.

Treadle Guard

Many serious accidents have occurred through objects falling on the foot treadle or the treadle being tripped accidentally by the operator or other person. Where a foot treadle must be used a hood guard or other device should be installed which will not interfere with the operation of the machine but will prevent accidental tripping. Two types of treadle guard are shown in Fig. 29.

Starting and Stopping

Every press should be equipped with a reliable friction clutch on the line shaft or with tight and loose pulleys to allow the power to be turned off when the press is not in actual use. If tight and loose pulleys are used be sure the loose pulley is kept well lubricated, so it will not seize on the shaft and start the machine unexpectedly. The belt shifter or clutch lever should be equipped with a latch or lock to prevent accidental shifting.

Adequate and substantial guards should of course be provided for all exposed driving belts and pulleys and for all gears.

The cleaning of dies or working parts of continuously operating presses while the machines are in motion should be prohibited. When repairing or cleaning a press the power should be thrown off. To lock the tripping mechanism or block the treadle is only partial protection, as it does not prevent an accidental stroke due to the pulley seizing the shaft.

Location and Lighting

The arrangement of presses on the factory floor should be such that operators and other employees will not interfere with one another and that material may be moved readily. Place the presses so a maximum amount of light will fall directly on the dies. Shadows, as from the revolving spokes of the flywheel or from belting, should be avoided. Electric lamps should be properly located, of suitable candlepower and equipped with reflectors to protect the eyes of the operators and throw the light on the work.

Do Guards Decrease Production?

An automatic feed which is recommended in this article as the best means of eliminating the operating hazard greatly increases production. A plunger inclosure for all blanking operations and for some forming

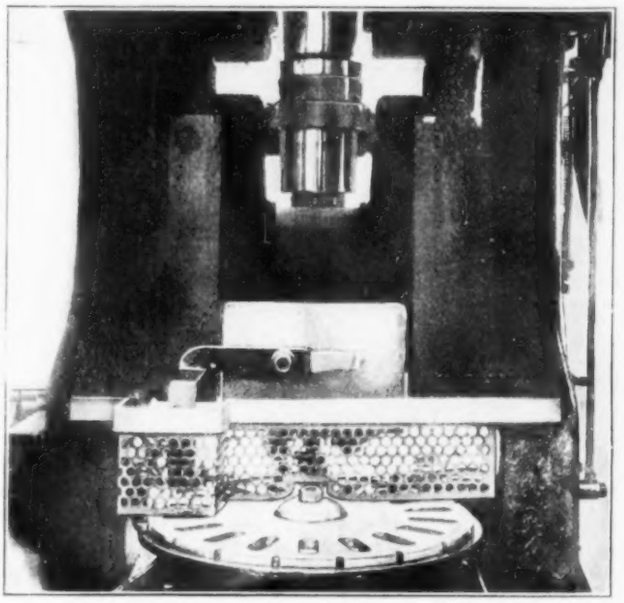


FIG. 28. A GUARD FOR REVOLVING DIES

operations increases production because it gives the operator a feeling of security against accident without interfering with his normal movements. This type of guard should therefore be used wherever possible. The same is true of the suggestion that the dies be constructed so there will be plenty of space for the operator's fingers. Automatic kick-outs and devices for inserting or removing material by compressed air or similar means also combine efficiency with safety. An automatic kick-out device used by the Aluminum Goods Co. is shown in Fig. 12. This is operated by foot power, and the company states that the hazard has been decreased and the production increased by its use.

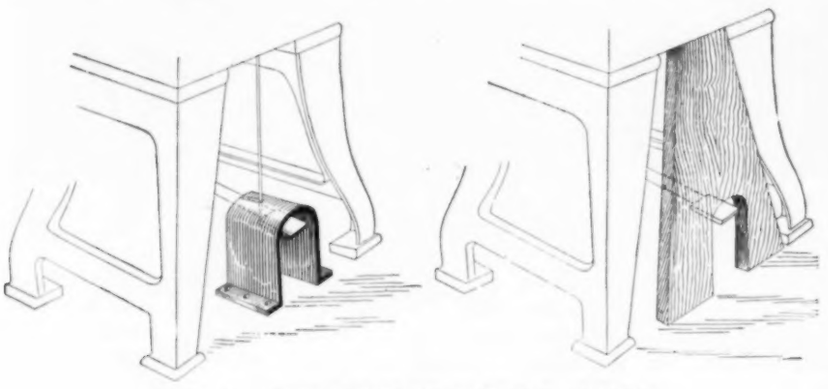


FIG. 29. TWO TYPES OF TREADLE GUARDS

Other safeguards, such as two-handed operating devices, sometimes decrease an operator's output per hour. Such types of safeguards are therefore not recommended if one of the first-mentioned types can be used. But even if one of these guards does lower the normal rate of production it must be remembered that without the guard production may be entirely stopped by an accident to the operator, while if a green operator is put on the machine he will require considerable time to attain the rate of output of the experienced operator. Production depends on keeping the operators continuously at work as well as on the hourly output while they are at work. Furthermore an initial decrease in output is often overcome or even changed into an increase when the operator becomes accustomed to the guard and realizes that he can give closer attention to his work if he does not have to be constantly on the watch to avoid injury.

Employing the Discharged Soldier

By Sergeant H. B. Riehl
School of Reconstruction, Camp Upton Base Hospital

There are three distinct types of men who have been wounded on the battle fields of France, and who, after treatment in the various hospitals, have been made fit once more (some of course to a higher degree than others) to take up the battle of life as civilians.

The three types are: First, the men who had completed their training in their trades and professions prior to their going into the service; second, the men who realize that they need further education to assure advancement in their chosen line of work, and third, the men who do not care whether, on return to civil life, they succeed or not. All that seems to interest them is that they have a job. It matters not the nature of the job, as long as it is "soft."

There are no doubt countless numbers of firms, employment managers and foremen throughout the country who intend, during the coming year, to employ, as far as possible, the returned soldier. If the firm is in the position of Henry Ford, who plans to hire all the returned soldiers residing in Detroit, regardless of their condition, mental or physical, the problem is quite simple. The policy of Mr. Ford is excellent, but all concerns cannot make such a sweeping business of hiring men. They must of necessity choose the best from their ex-soldier applicants and must recognize the three types and judge accordingly. The first type of men, those who had completed their training before service, are of course, in a sense, men of known worth, and the firms who pick men from this type will be satisfied with their choice. The men of the second type are especially worthy of consideration, not because they were better soldiers than the rest of their comrades, but because they strove, sometimes under great handicaps, to fit themselves for better jobs when they returned to civil life. The men of the third type could never be assets to any business, that is, in a competitive market or shops where men must care about themselves and their jobs.

The War Department has installed in practically every one of its hospitals in this country an educational department for the rehabilitation of its wounded soldiers. Primarily, the work was intended to have a therapeutic value; but it has developed rapidly to the extent where it has become work of a truly vocational nature. Many of the patients in the hospitals have taken advantage of the schools and the courses open to them—especially the non-English speaking men and those of the second type. These men have been quick to seize the opportunity of going to school and their enthusiasm and devotion to their classes is truly remarkable.

Most of the Men Attending the School Had Been Mechanics

The idea of writing this article came upon the interesting discovery that when men of the second type applied for work in the school—especially mathematics—they were, in almost every case, men who in civil life worked in machine shops. Even though many of these men were discharged from the hospitals before completing the course, the spirit and determination shown by them in their studies, and the loyalty shown to the school when taunted in the wards by their less industrious comrades, make them the worthy and logical choice of the firms who are looking for good men to become parts of their organizations. Spirit, determination and loyalty are three cardinal points of shop production, and men possessing these qualities will prove themselves assets in any line of work. The men of the second type have proved by their work in the schools that they have all of them.

To the men who, as far as possible, are planning to hire the ex-soldier it will be of advantage to recognize these three types and give the men of the second type the preference. I do not wish to infer that the men who did not attend school are not worthy; but that those who did make effort to improve themselves, often under great difficulties and handicaps, are the men who will make good with live, up-to-date concerns.

A Mechanical Mathematician

By

Ellsworth Sheldon,

ASSOCIATE EDITOR,
AMERICAN MACHINIST

THAT portion of a calculating machine which forms the connecting link between the operator's fingers and the registering mechanism is called in this machine the swinging arm. There are eight pairs of these arms in the Monroe machine, each pair being connected to a pair of clutches to which they transmit the movement of the keys. In Fig. 11 these arms are being assembled into the machine. They lie directly under and parallel to the vertical row of keys, each such row having its corresponding pair of arms. Pressure on any key below "6" will move one, and from "6" to "9" both, of the arms, which movement sets the clutches to register upon the dial the amount indicated by the key. One of the clutch shafts assembled is shown in Fig. 12. The shafts are made on the automatic screw machine and are later ground to insure accuracy. Four splines are then cut throughout their length, the fixture used, shown in Fig. 13, taking seven shafts at one loading. Three of the indexing devices are shown in the illustration, and there are four at the other end of the fixture. Each has a hardened-steel ring, in which are cut four notches accurately spaced to 90 deg. and a latch for locating them. The indexing is done by hand, each shaft being turned independently.

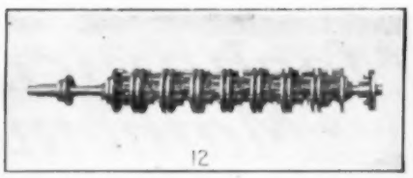
II. Construction and Assembling.

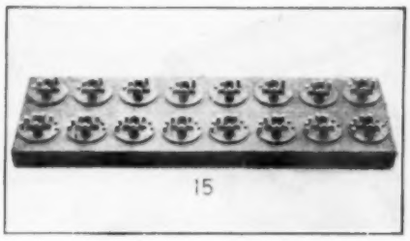
This second article continues the description of the details that go to make up a calculating machine, illustrates more of the tools and methods used and touches briefly on the assembling and testing of the finished product in which every precaution is exercised to detect imperfect machines.

FIG. 11. ASSEMBLING THE SWINGING ARMS

The four keys, or feathers, are ground to size and shape and are set into the shafts in the operation shown in Fig. 14. The upper part of the fixture used is made of tool steel and is hardened and ground. The two plates *A* are fastened to a die bed, and lengthwise through their abutting faces is a hole to fit a clutch shaft. The two pieces do not touch, but are spaced a distance apart equal to the thickness of a key. In each half-round groove thus formed in the steel pieces is a keyway, or slot, extending the full length, so that when the two pieces are in place there is between them an opening that just fits a completed clutch shaft with its four keys.

The operator slides a blank shaft into this hole from the end and drops a key into the upper slot between the faces of the steel parts. He then trips the press and the punch, a long, thin blade just fitting the slot (as also does the key) comes down on top of the key and forces it into the spline in the shaft. The gate is set at the proper height to send the key home and swage it slightly. Withdrawing the shaft, turning it one-quarter turn and reinserting it into the die the operation is repeated until all four keys have been set, the whole being completed in less than the time required to read the description. A final grinding follows on the top of the keys, or feathers, and the shaft is ready for assembling. Fig. 15 shows the clutches which operate the dials through the medium of the counting wheels. It will be noticed that one row of these parts has five studs of equal length extending from its face in a direction parallel with its axis, while in the other row there are but four studs each and they are of varying lengths. One each of these two parts constitute a pair, though, appearances to the contrary notwithstanding, no two of them are alike. The normal position in the machine of each pair of clutches is plainly shown in Fig. 12, each facing its mate with space enough between them to allow the teeth of the counting wheels to pass. There is a pair of these clutches corresponding to each vertical row of keys in the keybank. They are held apart by a light coil spring.





FIGS. 12 TO 15. OPERATIONS ON CLUTCH SHAFT
Fig. 12—A clutch shaft. Fig. 13—Milling splines in clutch shaft. Fig. 14—Setting the keys in the clutch shaft. Fig. 15—A set of clutches.

Pressing down the "1" key in any row advances the clutch which has four studs toward its mate far enough to bring the longest stud of the set into the path of the counting wheel, and when the driving shaft is rotated once this single stud steps the counting wheel one notch forward. Similarly the "2," "3" and "4" keys will advance this part of the clutch to bring a corresponding number of studs into action.

This part of the clutch does not respond at all to the "5" key, but the other side, which has the five equal studs, comes forward, and when turned by the driving shaft moves its counting wheel—the same wheel—five steps. This part of the clutch also responds to the "6," "7," "8" and "9" keys, each of which has two of the wedge-shaped projections on the lower end, as previously noted, and thus while each of these keys brings the left, or five-studded, clutch forward its full distance the right side of the clutch responds to "6," "7," "8" and "9" exactly as it did to "1," "2," "3" and "4," with the result that the combination of the two parts of the clutch moves the counting wheel 6, 7, 8 or 9 spaces for one revolution of the shaft.

Making the Clutches

The bodies of the clutches are made on automatics in the form of flanged bushings. They are then put on a fixture 18 at a time and the hub part straddle-milled, after which the oblong hole is cut through the center of the thin part on a punch press. The milling fixture is shown in Fig. 16.

The hub, or what is left of it, is then broached for the four keyways on a Lapointe broaching machine, and the flanges are drilled for the studs in jigs which locate them from the keyways. It is at this stage that these parts acquire their individuality, for as previously noted no two of them in the same calculating machine are alike. After the shouldered studs are riveted in, the clutch parts pass a milling operation which brings each stud to its required length.

Functions of Cam and Carrying Shafts

Up to this point the operation of the calculating machine is comparatively simple—certain studs controlled by certain keys get in the way of the counting wheel and push it along according to their number each time the clutch shaft is revolved. If, for instance, the "4" key is depressed and the operating crank turned once the dial above the row in which the depressed key is located will register 4; turn the crank again and we have added 4, the dial now registering 8. There are, however, but 10 steps on the dial, and if we turn the crank again, adding another 4, we will register 2. This is all right as far as it goes, but obviously there must be another movement—some way of pushing a job that has grown too big for one column of figures over onto the next one.

This is accomplished through the medium of the cam and carrying shafts, which at the time the first dial passes the 0 position cause a little sliding finger to reach out and move the dial of the next column one step forward. By this means, after the foregoing movement, the two dials together would register 12.

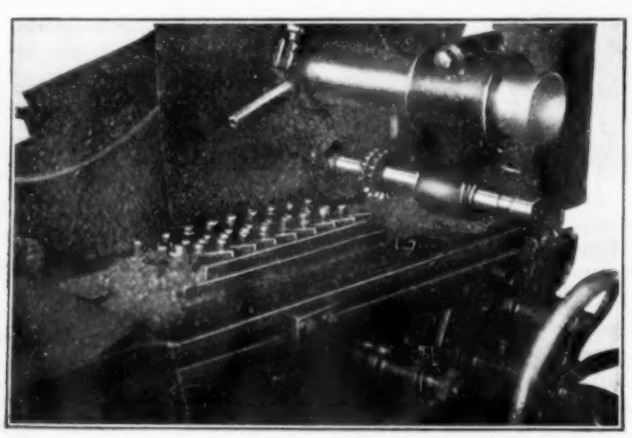


FIG. 16. STRADDLE-MILLING THE CLUTCH HUBS

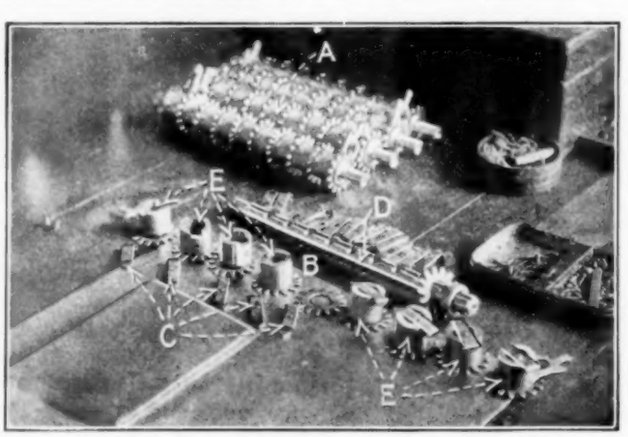


FIG. 17. ASSEMBLING A CAMSHAFT

The machine under discussion will subtract as readily as it will add by simply reversing the direction of rotation, and the finger that reaches over to move the next higher dial must be equally capable of undoing its work, and further, for this latter purpose, it must operate at a different time.

"Carrying up" to the Next Column

If the sole duty of the second dial was to record the revolutions of the first dial the problem would be greatly simplified, but it is quite likely that when "carrying up" a figure from the next lower column this second dial is also registering for a key in its own column, and the two movements must not interfere. The transmitted movements must follow the direct key movement in either direction.

Assembled camshafts are shown at *A*, Fig. 17, and

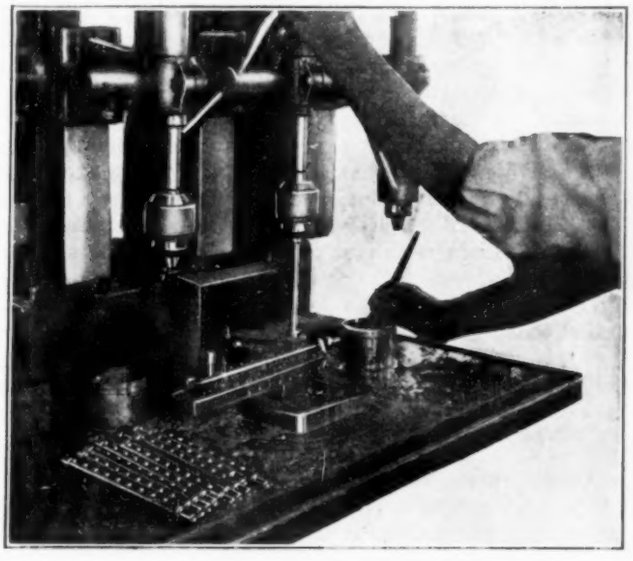


FIG. 18. DRILLING THE CAMSHAFT

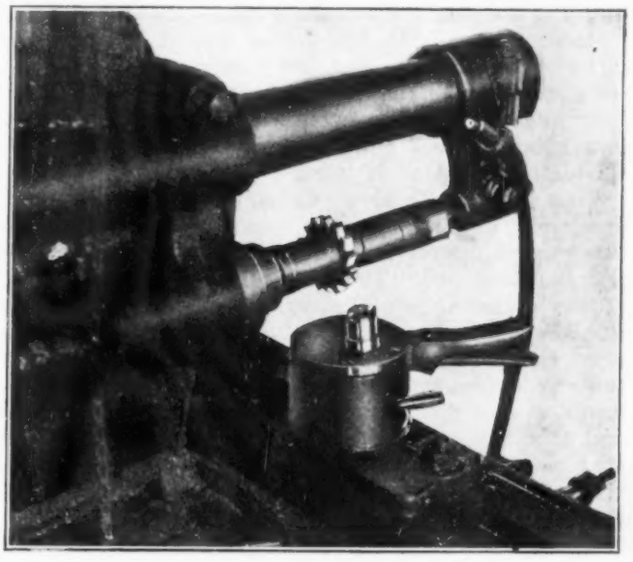


FIG. 19. SLOTTING THE BUSHINGS

one in process of assembling at *B*. Its position in the machine is shown at *B*, Fig. 10. It does not revolve, but the counting wheels on it are free and are turned by studs of the clutch transmitting the movement of the latter directly to the dials which are located in the carriage. The cams are the wedge-shaped pieces *C* which may be seen lying on the bench plate in Fig. 17, and when assembled they extend through the holes in the shaft *D* where they are held in position by the slotted bushings *E*. They stand in nearly vertical position and are free to move up or down a short distance, being held up by a spring or down by the latch which is a part of the cam.

Action of the Cams

The camshaft is located directly under the carriage, and when a dial passes the 0 position a stud presses down the corresponding cam, which latches and remains in position. This movement, however, does not move the next dial; it merely indicates that such movement is required, and the proper carrying dog attends to it at the right time, simultaneously releasing the latch and allowing the cam to resume its normal position so that the movement will not be repeated until the cam has again been set by its dial.

Fig. 18 shows the jig in which the cross-holes are drilled in the camshaft. The work is located on centers on the sliding carriage, being supported against the drilling pressure by a long V-block. The carriage is located for each hole progressively by the pin in the bracket on the front of the fixture. The drill bushing is of course stationary.

Fig. 19 shows a milling fixture which is used to mill the rectangular passage across the ends of the bushings through which the cams operate. A cut is also made at right angles to this passage, and the fixture is for the purpose of locating these two cuts. With the handle in the first position a cut is made straight across the center of the bushing, after which the handle is turned 90 deg. to its second position and the cutter passed again across the work. Owing to the fact that the center of the stud which locates the work is eccentric in relation of the center on which the fixture turns, this movement swings the work to one side at the same time that it is turned 90 deg., and the second passage of the cutter forms a flat spot at the end of the cam slot, providing a resting place for the latch that holds the cam down until the carrier dog reaches and releases it.

The Carriers

The carrying shaft is located in the machine back of and below the camshaft in such position that the carrying dogs when extended may reach a tooth of the counting wheel. The carriers are built up of sheet-steel stampings riveted to a hub which is produced on the automatics. Carrying shafts may be seen partly and completely assembled in Figs. 20 and 21, which show respectively the assembling and testing fixtures.

Position of Carriers Is Relative

The carrying shaft is driven by the operating crank through the same train of gears that operates the clutch shaft. The carriers are dogged to the shaft by pins extending through a slotted opening in their hubs in such manner that the carriers themselves, though positively driven by these pins in either direction, take up different positions according to the direction of rotation. When the crank is turned forward, as in addition or multiplication, the carriers collectively assume the appearance of a left-hand helix extending the

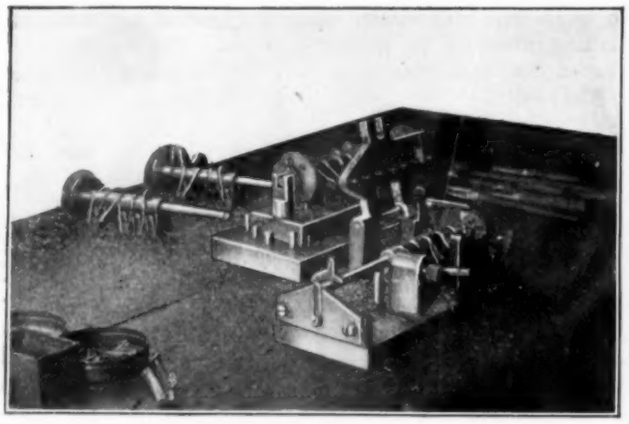


FIG. 20. ASSEMBLING THE CARRYING SHAFTS

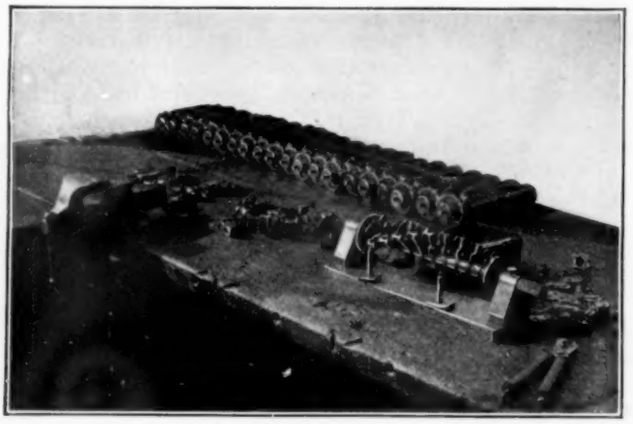


FIG. 21. TESTING THE CARRYING SHAFT

length of the shaft. When the crank is turned backward to subtract or divide, the helical line of carriers becomes right handed. This rearrangement of the carriers according to the direction of rotation brings the "carrying" from one column to next higher or lower column, as the case may be, in its proper sequence in whatever calculation is being performed.

Figs. 22 and 23 show respectively the lower and upper row of dials. In the upper row each dial has two sets of figures from 0 to 9, one set being black and the other red. These dials count the revolutions of the operating shaft, showing forward revolutions in black and backward turns in red, thus black figures represent factors in addition or multiplication, while the red figures indicate subtraction or division. The lower row of dials have but one set of figures each, and this row represents the result of any calculation that may be performed on the machine except in the case of division when the quotient is indicated in red figures on the upper dials.

Dials of Composition

The dials themselves are of molded composition, the upper ones having a toothed wheel as an integral part. The wheels are blanked, pierced and shaved in compound dies in the same manner as the counting wheels which they resemble. The wheels, however, have a row of small holes pierced just below the root of the teeth, and when one of them is set into the mold in which the dials are made and the plastic material forced in under pressure it flows through these holes and hardens there, the result being a composite steel and composition wheel which is practically one piece.

The steel portions of the lower dials are not toothed wheels, but instead have 10 studs extending from one side, like one-half of a "lantern wheel." These studs mesh with the teeth of the counting wheels. The tenth stud is longer than the rest and serves the additional purpose of pushing down one of the cams when it is necessary to "carry up" (or down) to the next column.

All dials and counting wheels are held by spring detents, which insure that a dial may not stop short or overrun its position, thus showing but half the figure in its individual opening through the carriage cover. The dials can come to rest only with a figure in proper register.

The dials must be so located in reference to the detent that the rows of figures appearing in the carriage openings will be straight and true, and in Fig. 23 may be seen the various gages by which this alignment is tested and adjusted.

Testing the Machine

After the machine is practically all assembled the operating crank is taken off and a sprocket wheel substituted. The machine is now run for several hours by an electric motor, during which period it gets a pretty severe mechanical test of its ability to stand up under continuous operation. From this test each machine goes to a man whose sole business it is to "put it on the bum."

It is the duty of this individual to make the machine show an error, and to this end he subjects it to every conceivable use, misuse or even moderate abuse, but it is to the credit of the makers that his efforts are seldom successful. It is safe to assume that the machine gets much more severe usage during the period that it is under test than it would be apt to receive in any regular office service unless it were to be dropped on the floor or some similar accident.

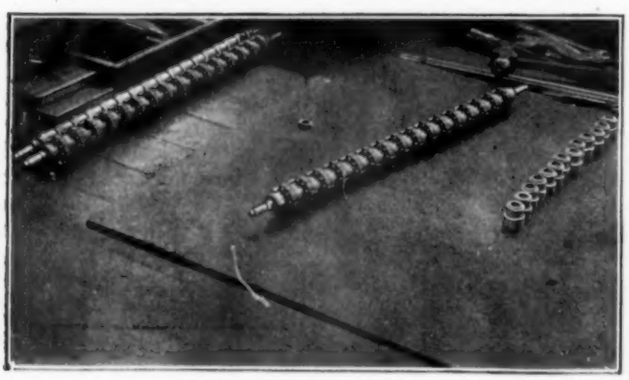


FIG. 22. LOWER DIAL SHAFT

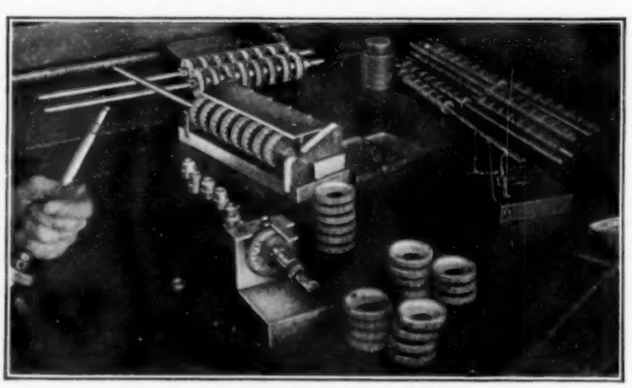


FIG. 23. UPPER DIAL SHAFT

The British Eight-Inch Howitzer—I

By I. WILLIAM CHUBB,
European Editor *American Machinist*

The British 8-in. howitzer consists of an A-tube, wire-wound over the chamber and a portion of the bore, an inner A-tube of practically the same length, and a jacket shrunk over the wire and a portion of the A-tube. The jacket bears the breech ring which supports the breech mechanism, the breech bush being screwed into the jacket. The methods here described are those of a long-established English firm which produces the howitzer complete for active service.

THE howitzer, Figs. 1 and 2, is of 8-in. bore, its total length being 148.3 in. and its weight with breech mechanism, nearly 7500 lb. The bore is 138.4 in. long; the chamber has maximum and minimum diameters of 9 in. and 8.5 in. respectively, and the rifling is 103 in. long, uniform twist, one turn in 35 calibers, the grooves being 48 in number and 0.349 in. wide by 0.06 in. deep. The A-tube, the inner A-tube and the jacket are all of nickel steel containing carbon, maximum 0.4; manganese, minimum 0.2, maximum 0.85; phosphorus, maximum 0.035; sulphur, maximum 0.035; silicon, minimum 0.05; maximum 0.2, and nickel, minimum 0.35 per cent. After rough-machining the forging is annealed at 1650 deg. F., oil-hardened at 1600 to 1700 deg. F., and tempered between 1000 and 1200 deg. F. The test pieces must show a tensile strength of between 45 and 50 tons to the square inch, the minimum elongation being 16 per cent. on a 2-in. length, the yield to be less than 0.03 in. at 30 tons. The test piece, when bent, is of U-form, the radius of the curve at the bottom being § inch.

As to testing it is usual when halfway through pouring the ingot for any of the tubes to cast a small billet. This billet is hammered to about 1¼ in. square, annealed and pulled for tensile test. Turnings are also taken for analysis, and if the results are satisfactory the ingot goes forward for its purpose. The bad metal both at the top and bottom is cut off and the ingot is bored, or trepanned if for a hollow forging, and when it has been forged to shape, annealed, oil-hardened and tempered rings are cut off, one at each end, for test, after being stamped by the government officials. The test rings are 1 in. thick, and for the inner and outer A-tubes and jacket four test pieces are taken from each ring, two for tensile and two for bending tests. The positions on the flat ring of metal from which these pieces are to be cut are marked off by scriber and center punch, the four pieces being arranged equidistantly around the ring at about the middle of its width and tangential, the pieces at opposite ends of a diameter being for the same kind of test, that is, those at the two ends of a vertical diameter may be for tensile tests, in which case those at the ends of the horizontal diameter would be for bending tests. Like tests are always made on diametrically opposite specimens. Cylindrical pieces 1⅜ in. in diameter by 4½ in. long, are trepanned at opposite diameters, two for tensile and two for bending tests, this applying to all forgings for guns of more than 3-in. bore, while if the forging is more than 48 in. long when finished, test pieces are taken from each end. A machine of the horizontal boring type is used, the hole being started first with a drill, followed by the trepanning tool. The cores formed by the trepanning process are broken out with drifts. The pieces band-sawn from the rings for tensile tests are first turned to 1 in. in diameter and are then turned and finally ground on the central portion 0.564 in. in diameter by 2.45 in. long between the shoulders, a length of 2.25 in. being parallel, plus a radius of 0.1 in. at each end.

The bending samples are first shaped to ¾ in. wide by ⅜ in. thick by 4½ in. long and then finished on a disk grinding machine to snap gages. In each case the government stamp is left on the end.

The testing machine, Fig. 3, depends on hydraulic pressure and is without operative weights, multiplying levers or knife edges, the pressure being exerted direct. The maximum pressure exerted is 50 tons per square inch.

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FIG. 1. EIGHT-INCH HOWITZER BODY

For the inner A-tube the ingot may be 30 in. or 32 in. octagonal by about 12 ft. long (including riser head) and from this three tubes are obtained. The ingot for the A-tube is 36 in. across the flats, octagonal, by about 18 ft. 6 in. long, including riser head, and from it four tubes are obtained, the forging sizes being shown in Fig. 4. The jackets are obtained from a 40 or 44 in. round ingot by about 12 ft. long, three jackets being produced therefrom. The forging for the inner A-tube is solid, but the jacket ingot is usually trepanned with a 16-in. hole right through before forging, and the A-tube with a 12-in. hole to take a mandrel while being forged.

In the trepanning process whether the cutting tool or the work shall revolve is determined mainly by the weight of the work, but the work is revolved wherever possible. In the case of the 8-in. howitzer ingots the tool does not rotate. Plenty of lubricant is an essential with the trepanning process and is conveyed by a pipe system through the center of the bar, running eventually from the tool into a culvert and passing through a settling tank before returning to a second tank from which it is again pumped. A mixture of soft soap and water is employed. The main object is not simply to cool the tool but also to wash away the cuttings.

The trepanning head, shown in detail in Fig. 5 has around it a series of hard-steel pads dovetailed in; these, when the tool has fairly entered, act as bearers and steady the head in the hole. The bottom part of the bar is cut away as far as possible without weakening it in order that the chips may readily pass away. The leading tool is a nicking or splitting tool shown to the right of the end view of the bar and in detail. By its action it forms two grooves in the work. It is followed by a broad tool, also detailed, which overlaps and breaks the cut into three, making five cutting edges in operation in a width of 2 in. or so. As to actual proportions a 13-in. trepanning bar will leave a solid core 7½ in. in diameter.

After trepanning the tubes are taken to a coal-fired muffle furnace for preheating to about 1500 deg. F. to insure that the metal will not crack when raised to forging temperature.

One of the presses used in forging the 8-in. howitzers is shown in Fig. 6 operating on a jacket. Its capacity is 3000 long tons. The main cylinder is of 40-in. bore by 60-in. stroke, and the clear distance between guides is 84 in. The distance between the under side of the anvil and the top cross head is 12 ft. 6 in. The working hydraulic pressure is 2½ long tons per square inch, the auxiliary accumulator service pressure being 16 cwt. per square inch.

In the chief machining operations on the three main tubes all turning and boring operations are dry, except at the finish-boring of the inner A-tube where oil is employed, this applying also of course to screw-cutting operations and the turning of radii as at the muzzle.

The A-tube when finished is 141 in. long by a maxi-

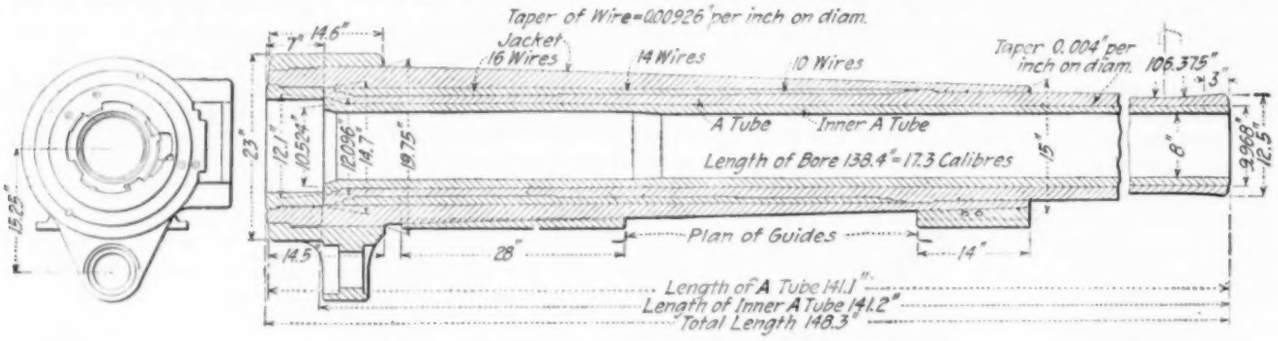

FIG. 2. SECTION OF 8-IN. HOWITZER BODY

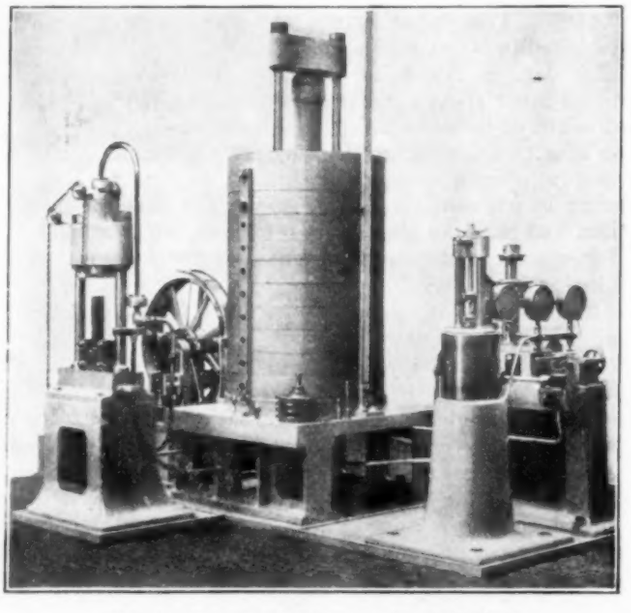

FIG. 3. FIFTY-TON TESTING MACHINE

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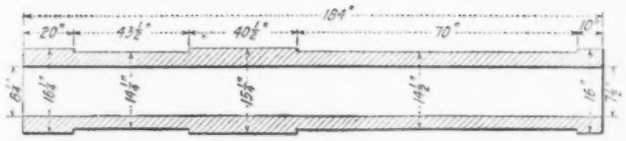

FIG. 4. A-TUBE FORGING

mum diameter of 14.7 in. at the breech end where there are three shoulders, the diameter at the muzzle end being 12.5 in., while the bore ranges from 12.1 in. at the largest step at the breech end down to 10.524 in. at the second step at this end, tapering 0.004 in. per inch on the diameter down to about 9.968 in. at the muzzle. For a length of about 136 in. the inner surface on the tube is combed.

Operation 1.—Rough-Turn—Rough-turning is done in an ordinary lathe of 36 in. swing and the cutting speed is about 18 ft. to 20 ft. per minute with a feed of 16 to the inch. It is usual to leave about 0.75 in. on the diameter, and a length of 12 in. or so, allowing for material to be removed for test purposes, etc.

Operation 2.—Rough-Bore—When boring from the solid the practice is to leave ⅜ to ½ in. on the diameter for a second cut, this being a margin for the nonconcentricity or running of the holes when the two cuts meet at the center of the length. The cutting speed is usually 20 ft. to 25 ft. per minute and the feed about 7 in. per hour.

The operation is double-ended, the machine used being illustrated in Fig. 7. The work is held in the center by four jaws on each side of the driving head and is supported at each end in a roller steadyrest. The machine illustrated is made by Hulse & Co., Manchester, and will bore work 9 ft. long from each end, making a total of 18 ft. The central driving headstock has a cast-iron hollow spindle rotated by two sets of steel double-helical gearing controlled by clutch and lever and driven from a 20-hp. variable-speed motor. The

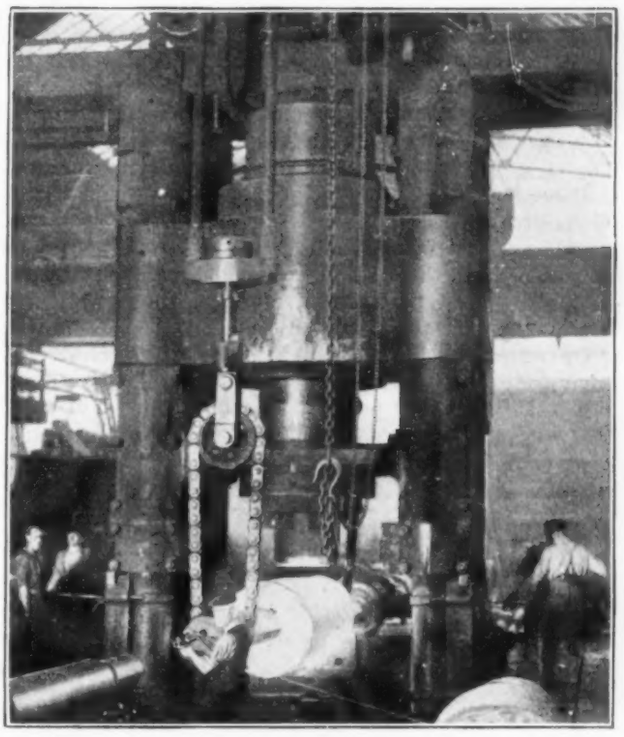

FIG. 5. THE TREPANNING HEAD

spindle speeds range from 4 to 36 r.p.m. and the center of the spindle is 18 in. above the bed. The two faceplate chucks are 4 ft. in diameter, each with four independent steel jaws and screws, steel removable extension plates being provided so that the range of tube taken is from 10 in. to 18 in. in diameter. The beds are each about 21 ft. long, of box form, with square gibs and inclined trough, each with a central screw, with wormwheel and worm at the end for self-acting motion to the carriage. The feed is reversed by the addition of an extra stud wheel on each swing frame. Quick power traverse is also obtained in either direction, with safety stop, being driven direct from a 3-hp. constant-speed reversible motor. Two carriages and two adjustable boring-bar holders are provided.

When boring from the solid each boring bar carries at its outer end an ordinary boring cutter of V-form to produce a hole 8¼ in. in diameter, the cut on each operating face being split, four notches being provided on one side and three on the other, arranged alternately. About 10 in. behind the operating end a 1 or 1¼ in. square knife tool is placed in

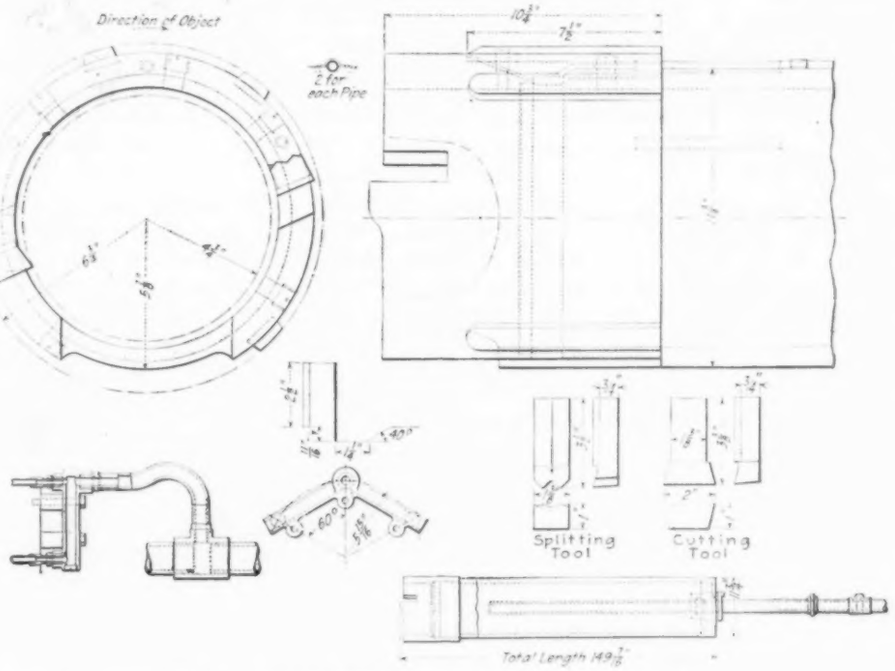

FIG. 6. THREE-THOUSAND-TON FORGING PRESS

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a slot across the bar, this opening the hole from 8¼ in. to 9¼ inches.

Operation 3.—Heat-Treat.

Operation 4.—Cut Off Test Pieces.

Operation 5.—Re-Turn and Cut Off Excess Material—The same lathe, etc., as used in operation 1 is employed, the speeds and feeds being about the same and the diameter turned leaving about ¼ in. on. As to the length it is usual to leave 1½ to 2 in. on to allow for the carrying up of the shoulders should there be any error in turning the taper. The removal of the excess metal is a simple parting-off job.

Operation 6.—Rebore and Finish Taper Boring—Reboring is done with a through bar, either with a taper slot to suit the tube or with a parallel bar set over. A single-point tool about 1 in. square is employed in this operation, though for reboring a knife tool is occasionally employed. For finishing about 0.3 in. is left on the diameter. A flat-face tool is used, with a radius tool to finish off the radii at the shoulders. In reboring the cutting speed is about 20 ft. per minute and the feed about 8 in. per hour, while for finishing with a broad-faced tool the feed is $\frac{1}{10}$ to ½ in. per revolution. Three or four finishing cuts are taken, sometimes even six, these removing any effects of cross pressure on the boring bar.

Operation 7.—Gaging.

Operation 8.—Combing—The grooves produced by combing are 0.01 in. deep by 0.05 in. wide, the pitch being 0.15 in. The combing tool of 1-in. square steel, produces five grooves at a time. The work is held in a dividing head of worm and wormwheel type and supported at the outer end on rollers, and the combing operation is from a given distance inside the muzzle end, running off at the breech end. A central bar is employed with a taper groove to take the holder for the combing tool, this being secured by two screws, one at the end and one at the side. The bar is held and supported by a pedestal at the front end of the job (see Fig. 8), and the tool is pushed along the groove by a bar operated by a carriage which receives longitudinal motion from a screw in the center of the bed. The cutting speed is 15 ft. per minute, the automatic return being in the ratio of 3 to 1. During the latter the cut is relieved by operating the cross-slide carrying the pedestal.

Operation 9.—Build—This is shrinking the outer A-tube on the inner A-tube.

Operation 10.—Finish-Turn for Wire—The work is held in a four-jaw chuck at the muzzle end, with either star or expanding center at the other end, and supported by a steadyrest, being turned up true at about half way along the length for a width of between 5 and 6 in. according to the width of the pads employed. Spotting diameters are turned at intervals to gages. The various diameters are turned to pin gages. The rest is set over to feelers between the two end diameters of the taper. The finish is with a carbon-steel tool 1¼ in. square, the tube running slowly, say at about 8 ft. or 10 ft. per minute, and the traverse of the flat-faced tool is ½ to ¾ in. per revolution.

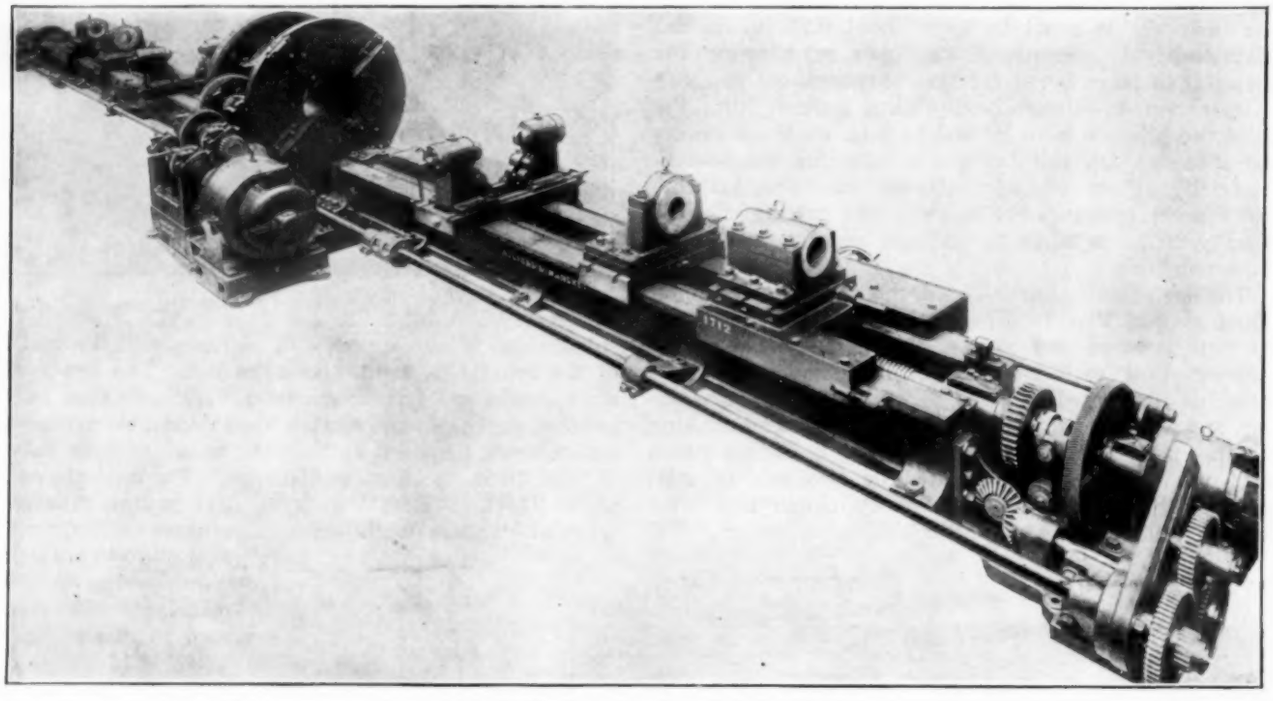

FIG. 7. DOUBLE-END BORING MACHINE

Operation 11.—Wire—For wiring an Armstrong-Whitworth machine is used, the operation being as described in connection with the 9.2-in. gun. Particulars of the wiring tensions in tons per square inch and also of the shinkages are given in Fig. 9. The wire is 0.06 by 0.25 in. section, each hank consisting of 2 cwt., or a length of about one mile, rather less than three

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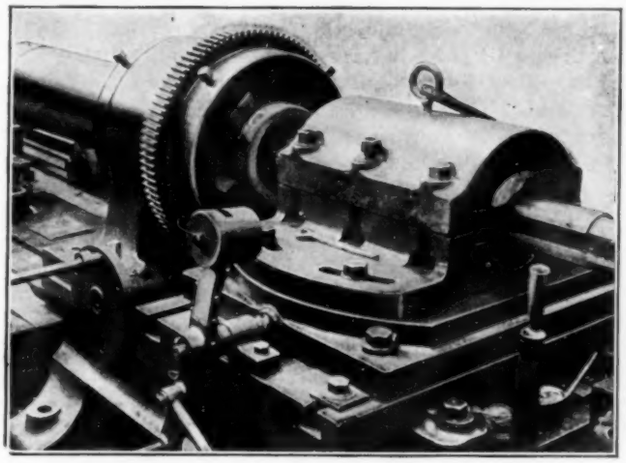

FIG. 8. COMBING OPERATION

miles being wound on this particular howitzer. To join two lengths the ends are milled taper for about a foot and these are riveted together overlapping. For this 32 holes are drilled in the 12-in. length, each $\frac{1}{32}$ in. in diameter, and countersunk for riveting, the two tapered ends being soldered together while drilling.

To start the wire on the gun a hole is drilled in the muzzle end of the tube, and from this a groove is cut in which the wire end is riveted with the ball of the hammer. For the split filling-in rings, 0.12 by 0.25 in. in section, a bending machine is used to get correct diameters.

The wire-coiling machine illustrated in Fig. 10 is electrically driven by a 5-hp. motor through a paper pinion. Hanks are slipped onto pegs on a small drum and placed, as shown in the end elevation, in bearings at the top of uprights, the wire then being brought down over a guide pulley through dies to the drum on which it is to be wound. The wire is previously cleaned by being run through paraffin. The tension in the wire-coiling machine is controlled by adjusting the cap of the tension device. The carriage bearing the dies through which the wire is fed receives a to-and-fro motion across the face of the machine, being driven by a screw which is itself driven by bevel gearing from the electric motor. A hand-controlled clutch reverses the motion at the end of the travel, the rate of which is suited to the width of the wire. The speed of the barrel on which the wire is wound varies in this case from 26 to 52 r.p.m. as controlled by the motor. This drum carries three hanks. From it the wire is wound onto others which carry up to 14 hanks, each of 2 cwt. The wire must be kept taut while being wound, as otherwise the tension might vary from that required when the wire is being wound on the gun.

Operation 12.—Turn on Wire for Jacket—For turning the wire on the jacket a 36-in. lathe is employed, the work being held in a four-jaw chuck at the muzzle end. At the other end is a star center, the bearing shoes of which carry heels in order that they may not be pushed in the tube. A bearing is turned toward the muzzle end, and after the wire has been turned as much as possible of the muzzle end is tapered by grinding. The wire is turned to diameter according to gages taken from a chart. Fig. 11 illustrates the nature of the operation. The spaces between the spotting positions are turned taper by swiveling the compound rest of the lathe, first removing its screw, and pushing by means of a bar from a second carriage on the lathe bed. The traverse is $\frac{5}{16}$ in. to $\frac{3}{8}$ in. per revolution; thus the tool is always bearing on two wires.

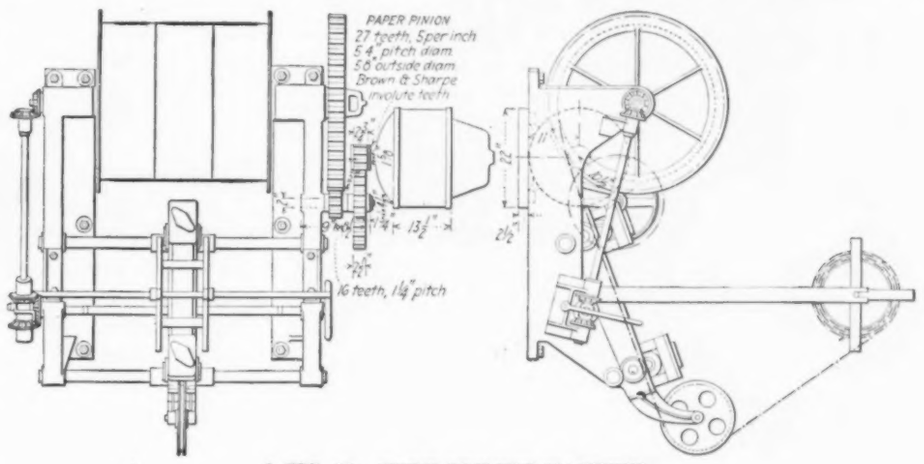

FIG. 10. WIRE-COILING MACHINE

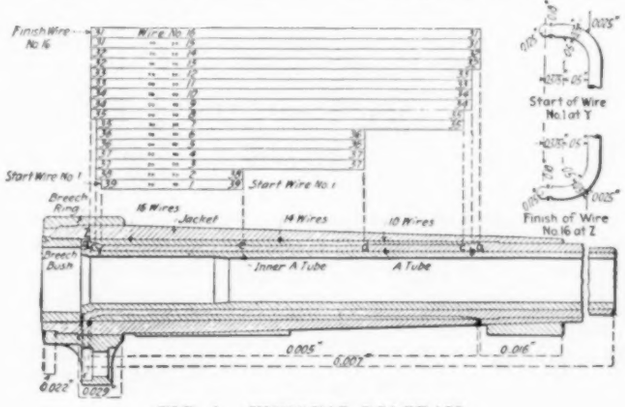

FIG. 9. WINDING DIAGRAM

At the same operation a broad cut is taken for finishing the muzzle end as far as possible which is roughed down to within 0.015 in. or 0.02 in. of size and then finished in about three broad cuts, the traverse being $\frac{1}{2}$ in. per revolution.

The inner A-tube when finished is 141.2 in. long and is bored 8 in. except at the powder chamber. A flange and shoulder are turned at the muzzle end to suit the corresponding recesses in the A-tube, the maximum diameter being 12.1 in. and the tube tapering to about 9.968 in.

Operation 1.—Rough-Turn—Rough-turning may be done in any suitable lathe of about 42-in. swing, the

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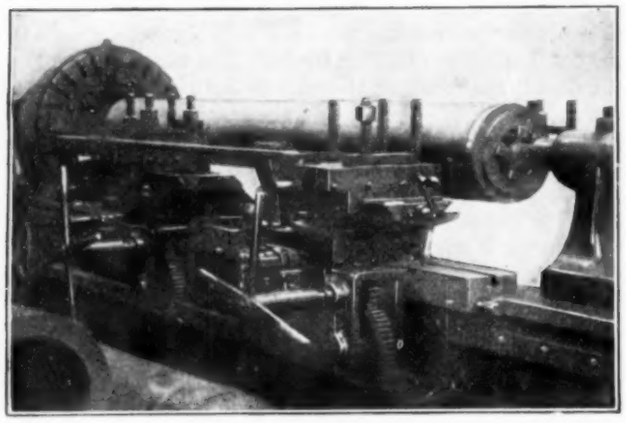


FIG. 11. TURNING THE WIRE

work being held at the muzzle end in a four-jaw chuck and the other end by a flanged center consisting of a circular metal plate centered on one side and bearing a flange taking four setscrews to hold the work. By the means employed for holding and driving, the work can readily be adjusted and centered. Four tools are used, about 1 in. coming off the diameter. The cutting speed is 25 ft. per minute and the feed is 20 per inch. The tools are of 1¾ in. square section, of high-speed steel.

Operation 2.—Rough-Bore—Rough-boring is much the same as for the outer A-tube, 0.75 in. being left on the diameter. A double-ended machine is employed, boring from each end, the work being driven by a chuck and running in a cylindrical fixture. In the case of the inner A-tube the boring is always initially from the solid. The cutting speed is 20 ft. to 25 ft. per minute.

Operation 3.—Heat-Treat.

Operation 4.—Cut Off Test Pieces.

Operation 5.—Re-Turn and Cut Off Excess Material—This process again corresponds with operation 5 on the outer A-tube, about ¼ in. being left on the diameter and 1¾ in. to 2 in. on the length.

Operation 6.—Rebore and Rough Chamber—The work is done to within 0.4 in. of finished diameters, and either a double-ended or single-ended machine may be employed, the job being run in cylindrical fixings. A knife tool of 1¼-in. square, high-speed steel is employed, backed by wooden packings on the bar, which are about 14 in. long and fit the bore, the tube face being cut by chisel in order to skim the wood blocks to the required size. The chamber is roughed parallel for a length to within about 1 in. from the start of the cone.

Operation 7.—Finish-Turn for Building—The work is driven in the lathe by a four-jaw chuck and supported at the breech end by a star center or conical expanding center. The tube is turned to within 0.015 diameter and then finished to gages supplied; a broad cut is taken, the speed being 20 ft. per minute and the feed ½ in. per revolution, three cuts being common.

PERSONALS

First Lieut. John A. Litzenberg has been discharged from the service. His duty overseas was repairing artillery. He was formerly employed by the Union Sugar Co., Batteravia, Calif.

* * *

Capt. Charles A. Straw, Jr., a Harvard graduate and whose permanent address is 1206 10th St., Washington, D. C., has received his discharge. He was formerly in the U. S. Patent Office and is a chemist.

* * *

Lieut.-Col. Charles E. Warren, of 60 East 42nd St., New York, who was transferred from the Q. M. C., as major, in May, 1917, has returned to civil life. He is a graduate of the University of California and is a banker.

* * *

Capt. Gar. A. Roush, whose home is at South Bethlehem, Penn., is a graduate of Indiana University and attended the University of Wisconsin. Before being commissioned, he was a professor of metallurgy at Lehigh University.

* * *

Capt. Floyd Evans, whose home is at 305 Fullerton Parkway, Chicago, Ill., was commissioned first lieutenant in July, 1917, and discharged in March, 1919. He is a graduate of Yale and was formerly with Butler Bros., at Chicago.

* * *

Capt. Gordon M. Evans, whose permanent address is 418 West 160th St., New York, has returned to civil life. He is a graduate of Cornell and was formerly engineering executive with the Menominee Motor Truck Co., Menominee, Mich. He has been on duty in the Manufacturing Division.

* * *

Maj. Milo M. Case was discharged recently after 21 months' service. He has been Army Inspector of Ordnance at the Bethlehem Steel Works. Major Case is a graduate of Lombard College and before entering the service was in business for himself as mechanical engineer. His permanent address is 6347 Greenwood Ave., Chicago, Ill.

* * *

Capt. Alexander Donald, whose permanent address is 825 Garfield Building, Cleveland, Ohio, and who was commissioned first lieutenant Nov. 17, 1918, has returned to civil life. His work in the Ordnance Department has been on motor vehicles and mobile repair shops. In civil life he was employed by the Hannah Engineering Works, Chicago, Ill.

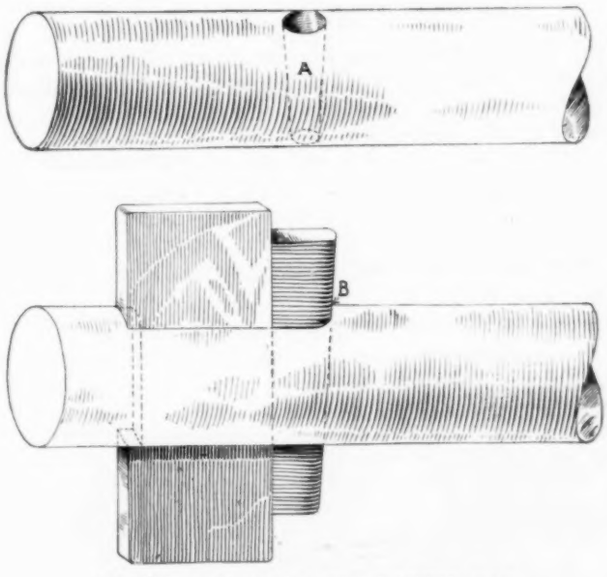
* * *

Maj. George S. Hardenbergh, whose home address is Eighth and Wacouta Sts., St. Paul, Minn., left the service on his return to America. Major Hardenbergh was commissioned first lieutenant in August, 1917, and twice promoted. In the service his work has been in connection with inspection of leather products, which is in line with his work in civil life. He is a graduate of Yale.

Taper-Pin Wedge for Boring Bar

By S. B. Royal

I consider the following to be the simplest and cheapest method of securing the tools in a boring bar. Before making the slot for the tool a hole *A* in the cut is drilled and reamed in the bar to accommodate a



TAPER-PIN WEDGE FOR BORING BAR

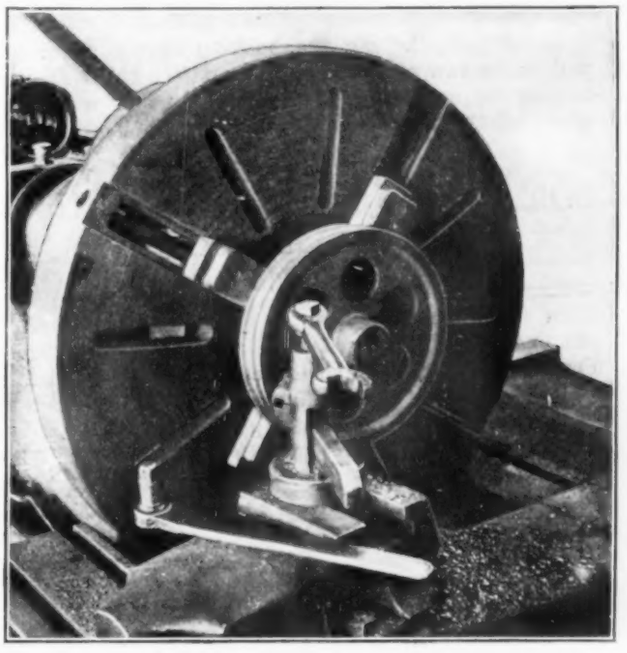
suitable size taper pin. The rectangular slot is then cut for the boring tool, the taper hole just reamed forming one end of the slot. A taper pin is filed flat on one side parallel with its axis and is case-hardened. The whole is assembled as shown at *B*, the taper pin forming a wedge that will never come loose.

An Old Lathe Chuck

By John Drew

A lathe chuck which has been in use for forty years is shown in the accompanying illustration. It was built as a special proposition, large lathe chucks not being so easily obtainable in those days as they are at present.

Notwithstanding its long period of service, the chuck is in perfect condition and has never cost a cent for repairs. This argues two things: good design and workmanship in the first place, careful and judicious handling in the second. Though constructed so many years ago, the chuck embodies some features that are usually considered as modern design. The outer piece of each jaw is held to its jaw by two fillister-head screws and a generous rib, so that its position can be reversed. The jaws are of steel and have ample bearing surfaces on the chuck body. The screws have hollow heads which come flush with the periphery of the flange and thus avoid the dangerous projecting heads that so often appear on chucks in common use. The



AN OLD LATHE CHUCK

wrench is shown lying on the apron of the compound rest.

Though the chuck is by no means heavy in proportion to its diameter of 30 in., it runs as true and grips as firmly as it did when new. As may be seen, it was right on the job when the picture was made, being stopped only long enough to make the necessary exposure with the camera.

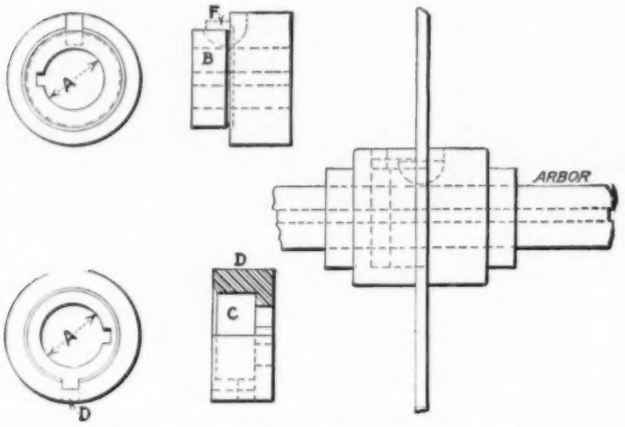
Holding a Slitting Saw on the Arbor

By Frank H. Walker

Herewith is a sketch of a special bushing for holding slitting saws on a milling-machine arbor.

It has been my experience in using large saws to have the saw bind, causing it to turn on the arbor. This often resulted in damaging the arbor, making it difficult to remove the saw and rendering it unfit for further service.

This bushing is made of machinery steel, pack-hardened, and ground. The holes *A* are made to fit the arbor. The shoulder *B* is ground to fit the hole in the saw. The recess *C* in the collar *D* is also of this



COLLAR FOR HOLDING SLITTING SAW

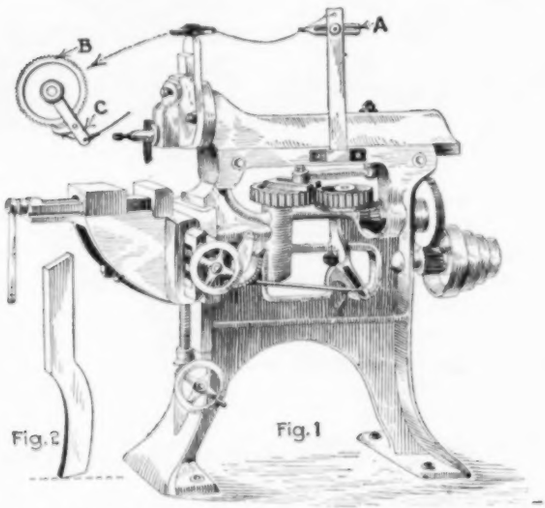
diameter. By keying the bushing to the arbor at *E* and to the saw at *F* and slipping on the collar *D*, it can readily be seen that if the saw slips it will merely shear off the key, which can easily be replaced.

Old Shaping Machine Rigged Up to Cut Off Stock

By F. W. Bach

In my apprentice days I remember seeing an old shaping machine rigged with a home-made automatic down feed which excited my curiosity and admiration.

The ram of the machine was driven through the medium of a pair of elliptic gears rotating in a horizontal plane, a moveable stud in the face of the driven gear and a connecting-rod. The stud was made with



FIGS. 1 AND 2. OLD SHAPING MACHINE RIGGED FOR CUTTING OFF AND THE CUTTING TOOL

a large T-head to slide in a radial slot on the gear, and the stroke of the ram was adjustable by loosening the binding nut on the top of the stud and setting the latter at the proper distance from the center upon which the gear revolved.

The machine was in use for cutting off 6-in. square bars of steel for drop dies, and except for resetting the bar for each cut and an occasional grind of the parting tool it required as little attention as a power hacksaw.

At the side of the machine shown in Fig. 1 was bolted a bracket and upright post carrying the adjustable bar *A*, which was slotted and held to the post by a stud and thumb nut.

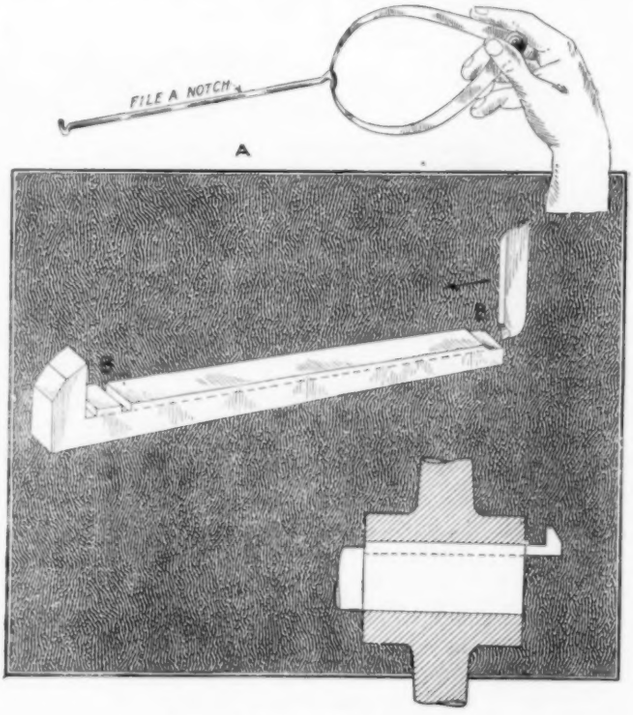
On the vertical feed screw was keyed the large ratchet *B*, on the hub of which was mounted the swinging arm *C* bearing the pawl.

A piece of belt lace completed the "feed works." The bar *A* was set so that the swinging arm struck it at the inner end of each stroke and was thus pushed forward to give the desired amount of feed while the length of the belt lace was so calculated as to pull it back at the outer end of the stroke. The tool used is shown in Fig. 2.

Fitting a Taper Key

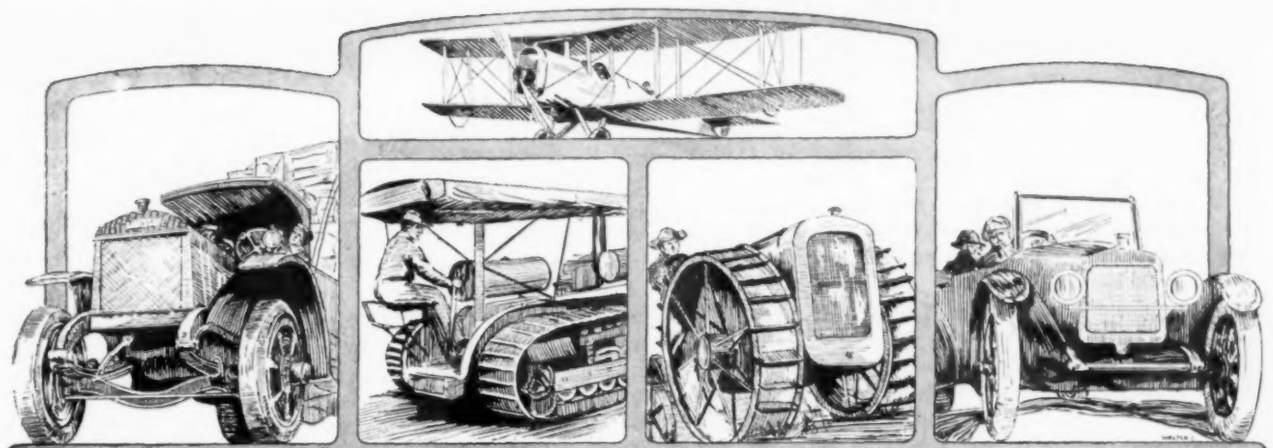
By M. Jacker

Instead of following the usual method of cut and try when fitting taper keys, take a wire of suitable size and bend it to the shape shown at *A* in the sketch. If the key is not to pass clear through the hub, determine the distance it is to enter and file a notch in the wire at this distance from one of the bent-up points. Next, file off the point of the wire until the latter goes into the keyway as far as the notch; the other point is then fitted to the large end of the keyway. Now file notches



FITTING A TAPER KEY

in the key as indicated at *B*, determining their depth by transferring the measurements from the points of the wire gage by means of ordinary calipers. The key may now be placed in the vise of the shaping machine, the tool set to the filed surface at the bottom of the notches and the key planed to the right taper on the first trial.



AUTOMOTIVE CONSTRUCTION

Finishing Operations on Liberty Motor Cylinders

By H. A. CARHART
Mechanical Engineer, Lincoln Motor Co., Detroit, Mich.

The finishing operations involve the use of some interesting fixtures, as shown by the illustrations. Many of these should be equally useful in other lines of work. The data concerning machines and tools used, as well as the time required, will be of value to those who are interested in production.

BEFORE proceeding further with machine operations, a preliminary water-test inspection is given each cylinder by putting air pressure in the water jacket and submerging it in water. Any defects are then corrected in the welding repair department shown in Fig. 1.

FINISH-TURNING THE PILOT DIAMETER AND FACING THE LOWER SIDE OF THE FLANGE—This operation is done on a 16-in. geared-head Reed lathe holding the cylinder on an expansion collet and locating for length from the inside of the dome. The pilot is then turned true with the bore, the flange faced true, and at the proper distance from the inside

FIG. 1. MAKING WELDING REPAIRS

AUTOMOTIVE CONSTRUCTION

of the dome, allowing grinding stock on both diameter and face. The capacity of one machine was 300 per day of nine hours, with a cutting speed of 111 ft. per minute and a feed of 0.025 in. per revolution.

FINISH-BORING, REAMING AND CHAMFERING—This is done on 3½-in. Acme turret lathes, with a special hollow hexagon turret, as shown in Fig. 2. The cylinder is located from the diameter and flange, finished in a preceding operation, in a loose adapter plate and held in place by four hook bolts on the flange. This adapter has a dowel fit in a special steadyrest chuck, to which it is attached by bolts through four keyhole slots in the adapter plate. The cylinder is then chamfered in the skirt in the first turret station. In the second it is bored with a single-point tool and the skirt faced to the proper length. The third station has a bar in the end of which are two tools set opposite, which finish-bore. Just behind these tools in the bar is a double-blade floating reamer of the "Kelly" type. This operation straightens out the bore which is distorted by the relieving of strains in the heat-treatment, and bores it true with the pilot diameter and flange face. One man produced 80 cylinders in nine hours on each machine; 18 machines being used, with a cutting speed of 146 ft. per minute and a feed of 0.0625 in. per revolution.

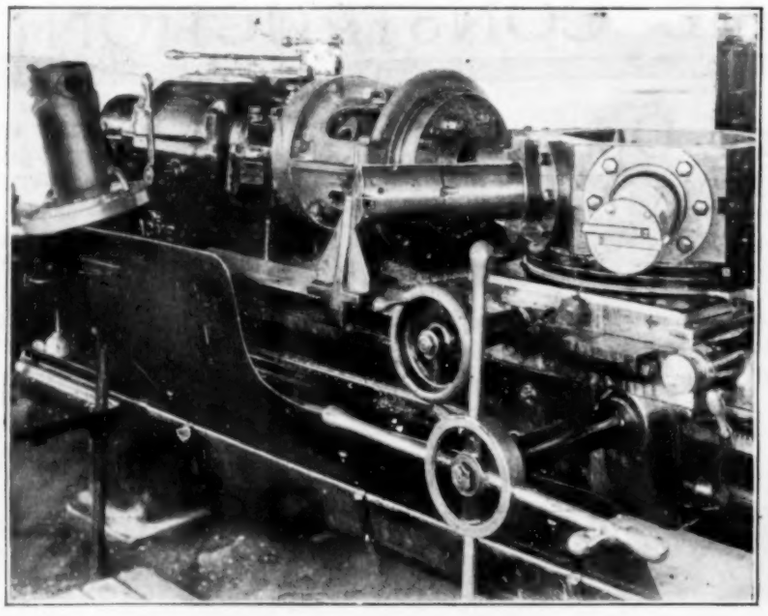


FIG. 2. FINISHING THE CYLINDER BORE

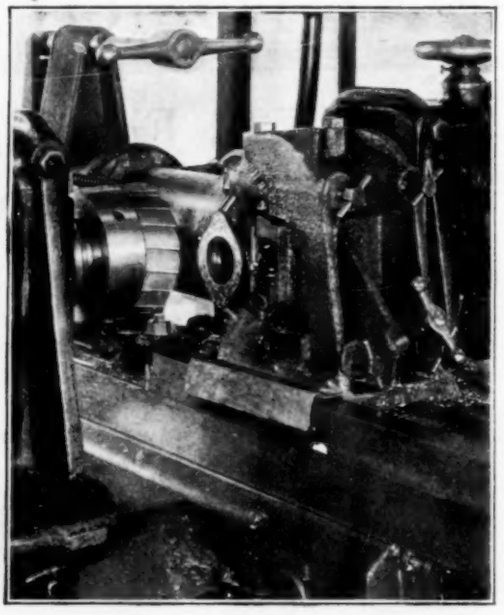


FIG. 3. MILLING THE PORT FLANGES

ROUGH-MILLING THE EXHAUST AND INTAKE FLANGES—A Duplex or double-spindle milling machine is used, with 6-in. diameter face mills, Fig. 3. The cylinder is located centrally on an expansion collet and for rotation by one of the flats on the bolt flange; this being the location point for welding on the port elbows. This operation consists of straddle-milling the port flanges allowing 0.010 in. for finish. The capacity per machine was 320 per day, with a cutting speed of 94 ft. per minute, and a feed of 0.083 in. per revolution.

DRILLING, REAMING, COUNTERSINKING AND SPOT-FACING THE VALVE-STEM GUIDE HOLES—This is done on a 21-in. drill press, using an index jig which allows both holes to be drilled in one setting. The cylinder is located centrally on a solid pilot in the bore and radially by equalizing clamps on the port flanges. This is shown in Fig. 4, which also shows the tools used.

The cylinder comes to this operation with a ½-in. hole already drilled in the elbows. The ½-in. hole is followed by a $\frac{31}{32}$-in. three-lip drill. A combination countersink and spot-face tool piloted in the drill bushing is next used, and is followed by three progressively sized pilot reamers to bring the hole to 0.685 in. in diameter, which allows 0.002 in. for hand reaming. Tool changes are accomplished by means of Wiard chucks. The capacity was 175 per day, using a cutting speed of 50 ft. per minute, and hand feed.

HAND-REAMING THE VALVE-STEM GUIDE HOLE—The cylinder is held in a fixture, which clamps on the skirt of the cylinder. The fixture is attached to a small bench, and the holes are hand-reamed to size, using a standard hand reamer and wrench. The output of this operation was about 270 per day.

DRILLING 10 BOLT HOLES IN THE FLANGE—A 20-spindle Natco multiple drilling machine is used, drilling two cylinders at a time. The tooling equipment consists of four jigs, as shown in Fig. 5. These are so situated on a rotating table that two jigs may be loaded while the other two are under the spindles and in operation.

The cylinder is hung upside down in the horseshoe ring by the bolt flange in the stationary, or lower part of the jig and located radially in relation to it by two hardened plugs in the valve-stem guide holes, locating in the slot in a hardened strip on the base of the jig. The bushing plate is a loose piece which locates over the cylinder on the pilot diameter and which locates itself and the cylinder in relation to the lower part of the jig by two hardened dowel pins. It is held down by two latches. The capacity of the machine is 900 per day with a cutting speed of 40 ft. per minute and feed of 0.048 in. per revolution.

AUTOMOTIVE CONSTRUCTION

REAMING THE EXHAUST AND INTAKE PORTS—This is done with a shell reaming machine through a bushing. The cylinder is held on an expansion collet, located by swinging the jig, Fig. 6, out from under the spindle of the drill press, and putting a three-point expansion locater through the bushing into the rough hole, before tightening up the collet, the idea being to merely clean out the welding flash in the rough hole. The capacity of the machine was 300 per nine-hour day.

REAMING, COUNTERBORING, SPOT-FACING AND TAPPING THE SPARK-PLUG HOLE—For this operation a 12-in. Cincinnati-Bickford drill press is used. The fixture has a solid pilot in the bore set at the proper angle and locating radially by a dowel in one of the bolt holes. The hole is re-drilled, spot-faced and counterbored with a combination tool, and tapped by running a tap clear through. The tap is 0.010 in. undersize on the pitch diameter to allow for hand tap. The capacity of the machine is 288 pieces in nine hours, with a reaming speed about 69 ft. per minute.

REAMING THE VALVE, CHAMFERING, SPOT-FACING AND MAKING THE VALVE SEAT—This is done on a 12-in. Cincinnati-Bickford drill press. The cylinder is hung upside down by the flange on an index trunnion. The indexing is done by a sliding pilot, in line with the drill spindle up through the valve-stem guide hole which also pilots the cutters. The operation is to ream the chamber with one bar, and seat and spot-face with another combination tool. This is shown in Fig. 7. The capacity was 255 pieces in nine hours, with a cutting speed on the reamer about 73 ft. per minute.

COUNTERSINKING THE INSIDE OF THE SPARK-PLUG HOLE—For this operation a 12-in. Avey drill press is used with a 13-in. riser in post. The cylinder hangs upside down, by the flange, in a trunnion which allows both holes to be countersunk with a $\frac{15}{16}$-in. drill. About 1000 pieces per day were produced on one drill press.

ROUGH-MILLING THE CAM HOUSING BOSSES—This is done on a No. 6 Whitney hand milling machine, with a 1½-in. six-fluted end mill. The fixture locates the cylinder for length from the under side of the bolt flange, and axially on an expansion collet in the bore. The capacity was 920 pieces per machine with a cutting speed of 35 ft. per minute.

DRILLING AND TAPPING THE CAM HOUSING BOSSES—A 10-in. Cincinnati drill press with tapping attachment is used. The cylinder is located axially on a solid pilot in the bore and radially from one of the holes in the bolt flange, as in Fig. 8. The holes are drilled and then the bushing is swung out of the way and the holes are tapped. With a cutting speed of 32 ft. per minute, one man did 350 pieces in nine hours.

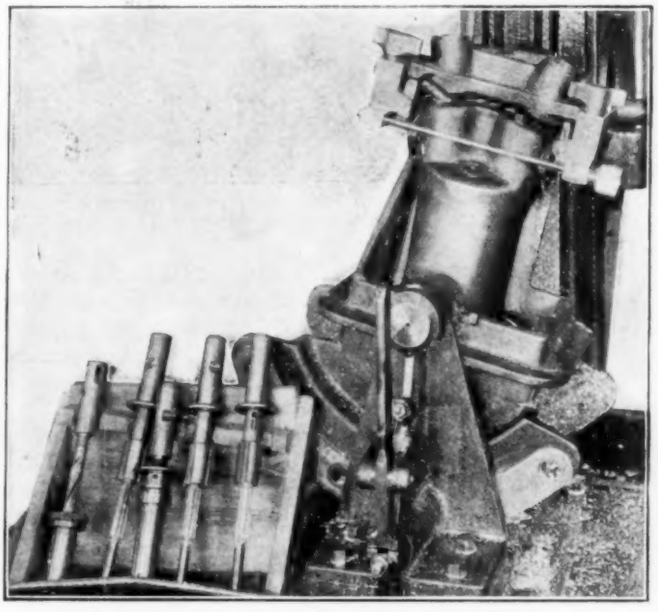


FIG. 4. DRILLING THE VALVE-STEM GUIDES

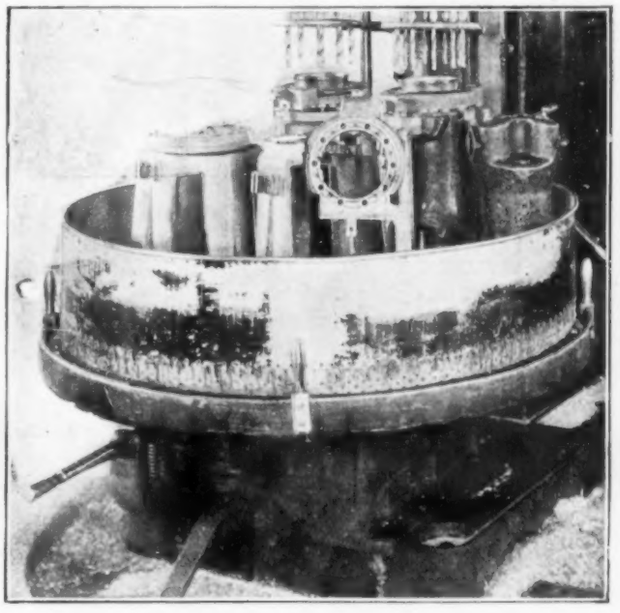


FIG. 5. DRILLING BOLT HOLES IN THE FLANGE

SLOTTING THE FLANGE BOLT HOLES—A No. 2 plain Cincinnati milling machine is used, having two cutters suitably spaced on the arbor. The cylinder is located from the pilot diameter, clamped on the flange, and located radially by one of the bolt holes in the flange. The operation is to mill two slots, take the cylinder out, turn it over and mill the other two slots. The capacity of the machine was 900 in nine hours, with a cutting speed of about 63 ft. per minute.

HAND-TAPPING THE SPARK-PLUG HOLE—The same kind of a stand and fixture is used in this operation as in hand-reaming the valve-stem guide holes. Both holes are then tapped with a standard handtap 18 mm. x 1.5 mm. with a special extension tap wrench. The capacity was about 280 per day.

The cylinder is now washed in a hot soda solution to remove the grease and oil before grinding. It is next given a rough inspection before further operation.

ROUGH-GRINDING THE PILOT AND FLANGE TO REMOVE BURRS—The swivel table is removed from a Norton 10 x 32 plain grinding machine and a special head substituted which holds the cylinder on an expansion collet in the bore and locates for length from the inside of the dome. The output was about 800 per day.

AUTOMOTIVE CONSTRUCTION

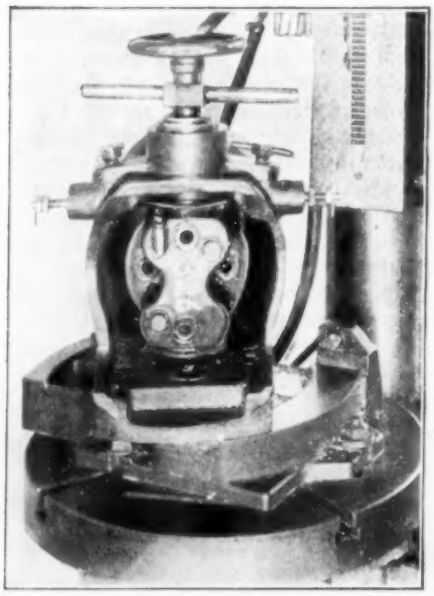


FIG. 6. REAMING THE PORTHOLES

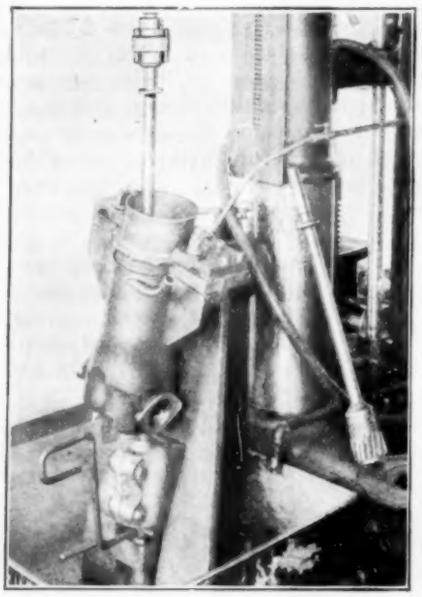


FIG. 7. MACHINING THE VALVE SEAT

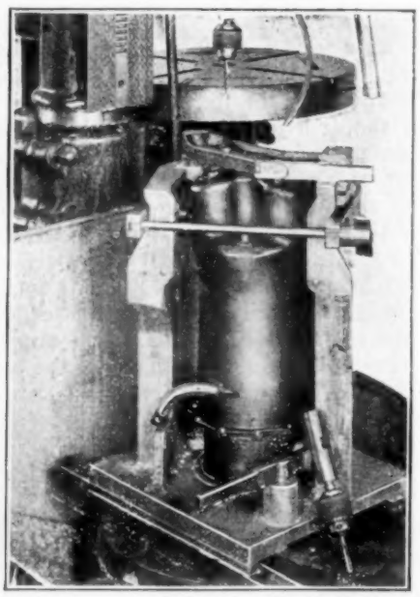


FIG. 8. DRILLING FOR THE CAM HOUSING

ROUGH-GRINDING THE BORE TO 4.993 IN.—This is done on a Heald No. 60 cylinder grinding machine, the cylinder being located in the fixture by the pilot diameter and the bolt flange. From three to four cuts are required to bring it to size. The capacity of the machine was 45 cylinders per day, with the wheel having a cutting speed of about 98 surface feet per minute, and the longitudinal feed, about 0.144 in.

FINISH-GRINDING THE BORE TO 4.999 IN. TO 5.001 IN.—The machine and tools are the same as in the preceding operation, this operation being to bring to size and a good finish. Fig. 9 shows the cylinder in the fixture. The cylinder is given a second washing to remove the emery and grit of the grinding operations.

FINISH-GRINDING THE PILOT AND THE BOLT FLANGE TO SIZE—The machine and tools are the same as for rough-grinding the pilot and the flange, with the exception that a special indicator is attached to the special headstock for gaging the face of the flange from the inside of the dome. The wheel used is a Norton 20 x 3 x 12 in., combination 3836 M., with a surface speed of about 235 ft. per minute. The capacity was 170 pieces per day.

FINISH-MILLING THE CAM HOUSING BOSSES—This is done on a No. 2 plain Cincinnati milling machine, using a spiral slab mill. The cylinder is located from and clamped on the flange face. The fixture shown in Fig. 10 is used, with a test fixture, and two dial indicators.

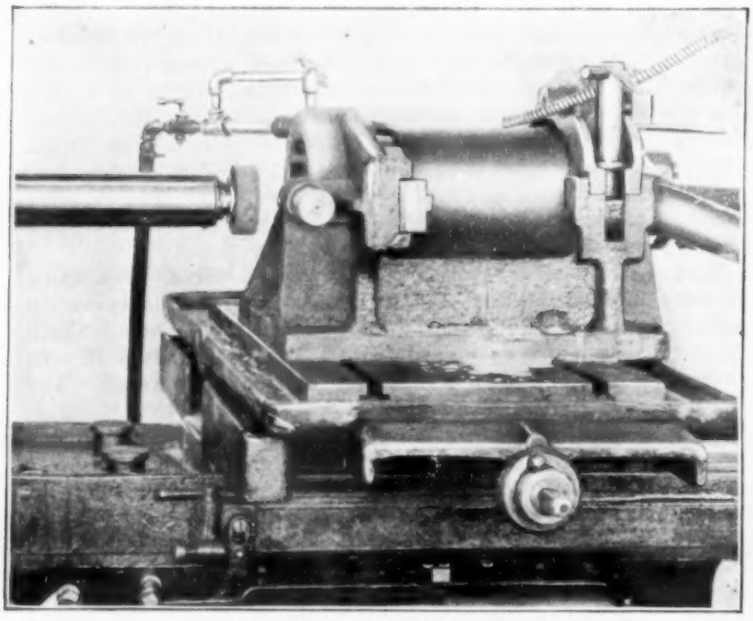


FIG. 9. GRINDING THE CYLINDER

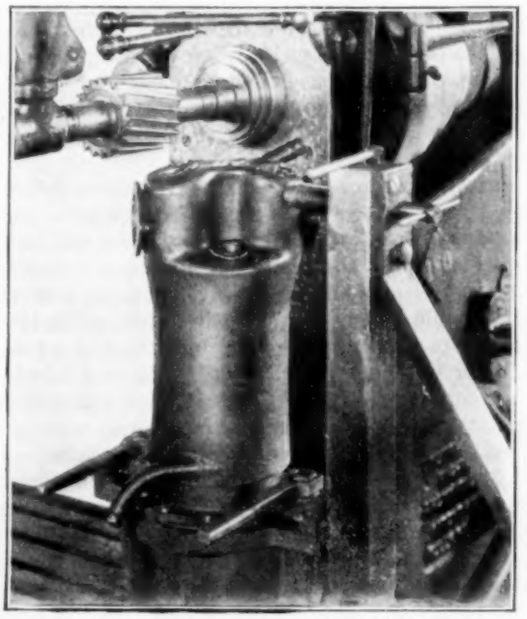


FIG. 10. MILLING THE CAM-HOUSING BOSS

AUTOMOTIVE CONSTRUCTION

The capacity of one machine was 350 pieces per day, with a surface speed of 84 ft. per minute and a feed of 0.071 in.

REAMING 10 HOLES IN THE BOLT FLANGE—This operation is done on a single-spindle 24-in. Reed-Prentice drill press with a 10-spindle head. The operation is to bring the holes to size and concentric to the pilot diameter. The production was 1000 pieces per day, with the speed of the drills running at about 30 ft. per minute.

FINISH-FACING THE TOP OF THE FLANGE—In this operation the cylinder is held on an expansion collet in the bore, on a 16-in. lathe, Fig. 11, and located for length on the under side of the flange. A special hook

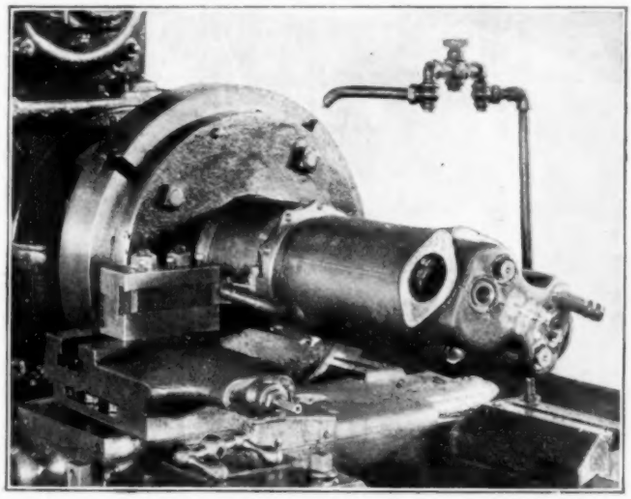


FIG. 11. FINISHING THE TOP OF THE BOLT FLANGE

toolholder is required to dodge the lower water pipe. The production was 150 pieces per day, with a cutting speed of 71 ft. per minute and a feed of 0.016 in. per revolution.

FINISH-MILLING THE INTAKE AND EXHAUST FLANGES—This is done on a Garvin duplex milling machine and is practically the same as the rough-milling operation except that the cylinder is located axially on the pilot diameter and clamped on the flange instead of a collet in the bore. The production was 300 per day on one machine, with the cutting speed about 141 ft. per minute, and feed of 0.0435 in.

DRILLING THE EXHAUST AND INTAKE PORT FLANGE HOLES—A 14-in. single-spindle Leland-Gifford drill press is used. The cylinder is located in the reversible jig by the pilot diameter, clamped on the flange and located radially by hardened blocks on the port flanges. The production was 350 pieces per day.

TAPPING THE PORT FLANGE HOLES—This is done on a Garvin automatic tapping machine, the cylinder being held in a cradle while under operation. The tap used is $\frac{3}{8}$ in. x 24 in., about 0.010 in. undersize. The production was 300 pieces per day.

COUNTERSINKING THE HOUSING AND PORT FLANGE HOLES—An 82-deg. countersink is used in a single-spindle Leland-Gifford drill press, the cylinder being set on the table for the housing boss holes and held up to the cutter on the port flange holes. The capacity was 900 per day.

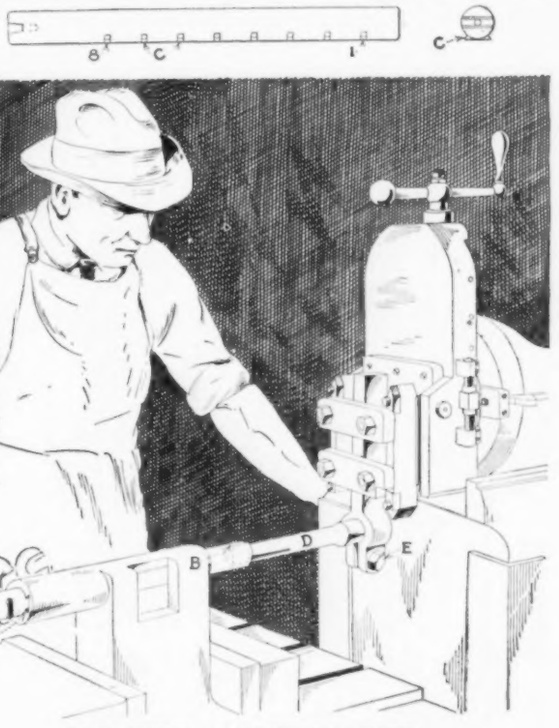
The cylinder is then washed out and cleaned all over in boiling soda water. A final inspection is given before the studs and valves are assembled to it.

Broaching in a Shaping Machine

BY CHARLES RUNZI

The problem of cutting the dovetailed slot at *A* in the rear sight bracket shown in the figure was solved by the construction of six special broaches and the holder shown at *D*. The slot had to be perpendicular to the base of the bracket and its depth was limited to a variation of 0.0005 in.

The job was done in a shaping machine and the holder mentioned above was made up to fit the toolholder of the ram. An auxiliary ram, shown in position in the holder, was constructed with a tongue to fit the groove *B* in the end of each broach. The broaches were made



BROACHING A SIGHT BRACKET

of machine steel turned down 0.0005 in. smaller than the hole in the bracket and the cutters were peened in place as shown at *C* and ground. The widths of the eight cutters increased uniformly, and as there were six broaches for the job, this meant the making of 48 cutters of assorted sizes.

The actual operation was performed in the following manner. The holder was fastened in the toolpost of the shaping machine, and the capscrew *E* was loosened to allow the auxiliary ram to be set so that the bases of the cutters were square with the table. When the broach and work had been squared up they were champed to the holder and table respectively, and the job was quickly done by pushing the broaches through in order.

CHART FOR USE IN APPRAISAL OF STANDARD MACHINE TOOLS TO DETERMINE SERVICE VALUE.

A IN USING THIS CHART ASCERTAIN FROM BEST SOURCES, AS COMPLETELY AS PRACTICABLE, PREFERABLY FROM SHOP SUPERINTENDENTS, FOREMEN, U S INSPECTORS OR PLANT RECORDS, FOR EACH TOOL OR GROUP OF TOOLS
1. ACTUAL TIME OF USE IN YEARS,
2. AVERAGE NUMBER OF HOURS PER DAY IN USE,
3. CLASS OF USAGE AND UPKEEP (SEE CURVES BELOW)

B REDUCE THE ACTUAL TIME OF USE (A1) TO THE EQUIVALENT STANDARD 8 HR DAY USAGE BY THE REDUCTION FACTOR OBTAINED FROM SMALL CHART ON THE RIGHT

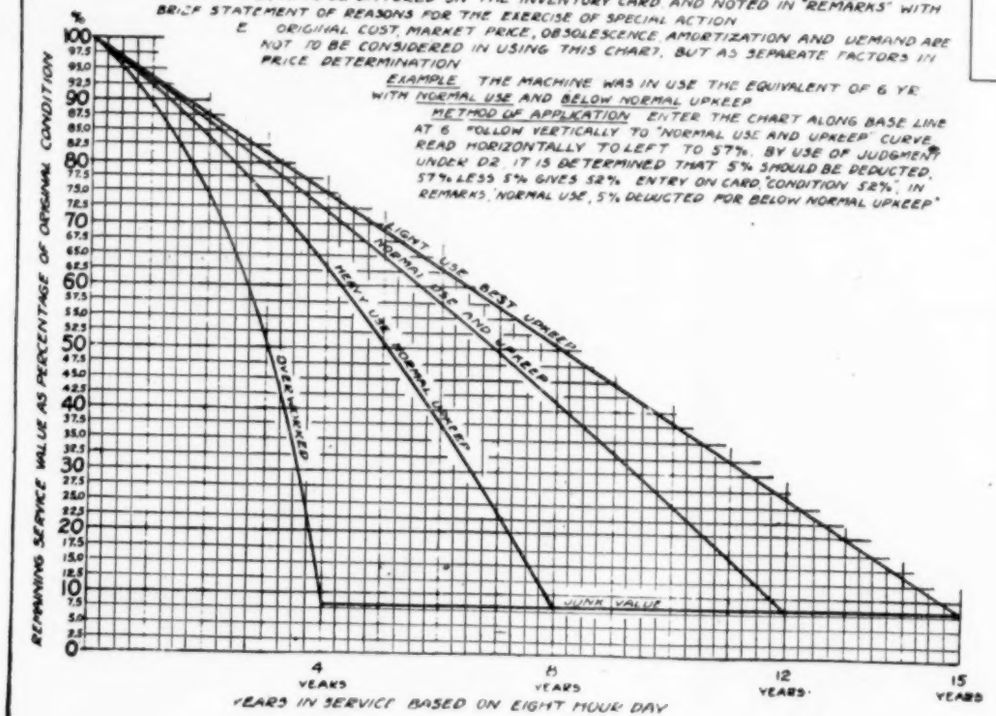
C ENTER MAIN CHART BELOW WITH EQUIVALENT YEARS OF USE (B) ON BASE LINE, READ VERTICALLY TO APPROPRIATE CURVE (A3), THEN HORIZONTALLY TO LEFT FOR PERCENTAGE OF CONDITION. THIS PERCENTAGE IS TO BE RECORDED ON INVENTORY CARD UNLESS ALTERED IN ACCORDANCE WITH PARAGRAPH FOLLOWING (D)

D EXAMINE THE TOOL FOR EVIDENCES OF
1. EXCEPTIONALLY GOOD CARE MAINTENANCE AND OPERATION, ABOVE NORMAL. IF JUSTIFIED, THE PERCENTAGE DERIVED UNDER PRECEEDING PARAGRAPH (C) MAY BE INCREASED, BUT NOT TO EXCEED FIVE (5%) PERCENT
2. ABUSE OR EXCEPTIONALLY POOR CARE, EITHER IN USAGE, UPKEEP, HANDLING OR STORAGE, BELOW NORMAL. IF JUSTIFIED THE PERCENTAGE DERIVED FROM PRECEEDING PARAGRAPH (C) MAY BE DECREASED, BUT, IN GENERAL, NOT MORE THAN TEN (10%) PERCENT. THE USE OF THE OVERWORKED CURVE WILL COVER MOST CASES
3. BROKEN OR MISSING STANDARD PARTS OR EQUIPMENT. THIS CAN BE TAKEN CARE OF BY AN APPROPRIATE REDUCTION FROM THE PERCENTAGE PREVIOUSLY DETERMINED, UNLESS COST OF REPLACEMENT CAN BE ESTIMATED WITH REASONABLE ACCURACY, WHICH IS PREFERABLE
4. THE PERCENTAGE DETERMINED BY CONSIDERATION UNDER PARAGRAPH C, AS ALTERED UNDER PARAGRAPH D, IS TO BE ENTERED ON THE INVENTORY CARD AND NOTED IN "REMARKS" WITH BRIEF STATEMENT OF REASONS FOR THE EXERCISE OF SPECIAL ACTION

E ORIGINAL COST, MARKET PRICE, OBSOLESCENCE, AMORTIZATION AND DEMAND ARE NOT TO BE CONSIDERED IN USING THIS CHART, BUT AS SEPARATE FACTORS IN PRICE DETERMINATION

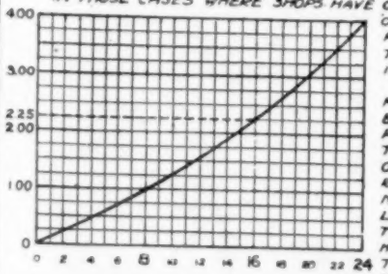
EXAMPLE. THE MACHINE WAS IN USE THE EQUIVALENT OF 6 YR WITH NORMAL USE AND BELOW NORMAL UPKEEP

METHOD OF APPLICATION. ENTER THE CHART ALONG BASE LINE AT 6 FOLLOW VERTICALLY TO "NORMAL USE AND UPKEEP" CURVE, READ HORIZONTALLY TO LEFT TO 57%. BY USE OF JUDGMENT UNDER D2, IT IS DETERMINED THAT 5% SHOULD BE DEDUCTED, 57% LESS 5% GIVES 52%. ENTER ON CARD "CONDITION 52%", IN REMARKS "NORMAL USE, 5% DEDUCTED FOR BELOW NORMAL UPKEEP"



REDUCTION FACTOR

THIS CHART IS TO BE USED IN CONJUNCTION WITH THE MAIN CHART TO OBTAIN UNIFORMITY OF RESULTS IN THOSE CASES WHERE SHOPS HAVE OPERATED AT OTHER THAN 8 HR PER DAY, ON WHICH THE MAIN CHART IS BASED.



HAVING DETERMINED THE NUMBER OF HOURS PER DAY AT WHICH THE TOOL WAS OPERATED (A2), READ FROM THIS NUMBER ON BASE LINE VERTICALLY TO CURVE, THEN HORIZONTALLY TO THE SIDE FOR THE REDUCTION FACTOR.

EXAMPLE. THE MACHINERY IN THE PLANT WAS OPERATED FOR A PERIOD OF 1½ YR (A1) AT 24 HR PER DAY (A2).

METHOD OF APPLICATION: FROM THE CHART THE FACTOR IS FOUND TO BE 4.00 FOR 24 HR USE. MULTIPLY THE PERIOD OF ACTUAL USE, 1½ YR, BY FACTOR 4.00. RESULT 6, WHICH IS THE EQUIVALENT NUMBER FOR YEARS ON 8 HR USAGE AND IS THE TIME TO BE USED IN READING THE MAIN CHART

CONDITION APPRAISAL CHART

PREPARED BY CONFERENCE WITH VARIOUS WAR DEPARTMENT BUREAUS AND THE WAR INDUSTRIES READJUSTMENT COMMITTEE, AMERICAN SOCIETY OF MECHANICAL ENGINEERS.
APPROVED BY THIS COMMITTEE AS BEING IN ACCORD WITH BEST ENGINEERING PRACTICE BY CHARTS AND LETTER, MAY 23, 1919

RECOMMENDED BY
CLAUDE E FITCH
MAJOR ORD DEPT U.S.A.
SALVAGE BOARD, ORDNANCE DEPARTMENT

APPROVED BY
DWIGHT K SHURTLEFF
LT COL ORD DEPT U.S.A. CHAIRMAN

W C LAWRENCE

C S SHURTLEFF
CAPT AIR SERVICE, U.S.A.
MATERIAL DISPOSALS DEPARTMENT AIR SERVICE

R A ADAMS
CAPT ENGINEERS U.S.A.

G F GOODWIN
MAJOR ENGINEERS, U.S.A.
MACHINE TOOL SECTION, M & E BR.
SURPLUS PROPERTY DIVISION, PURCHASE STORAGE & TRAFFIC

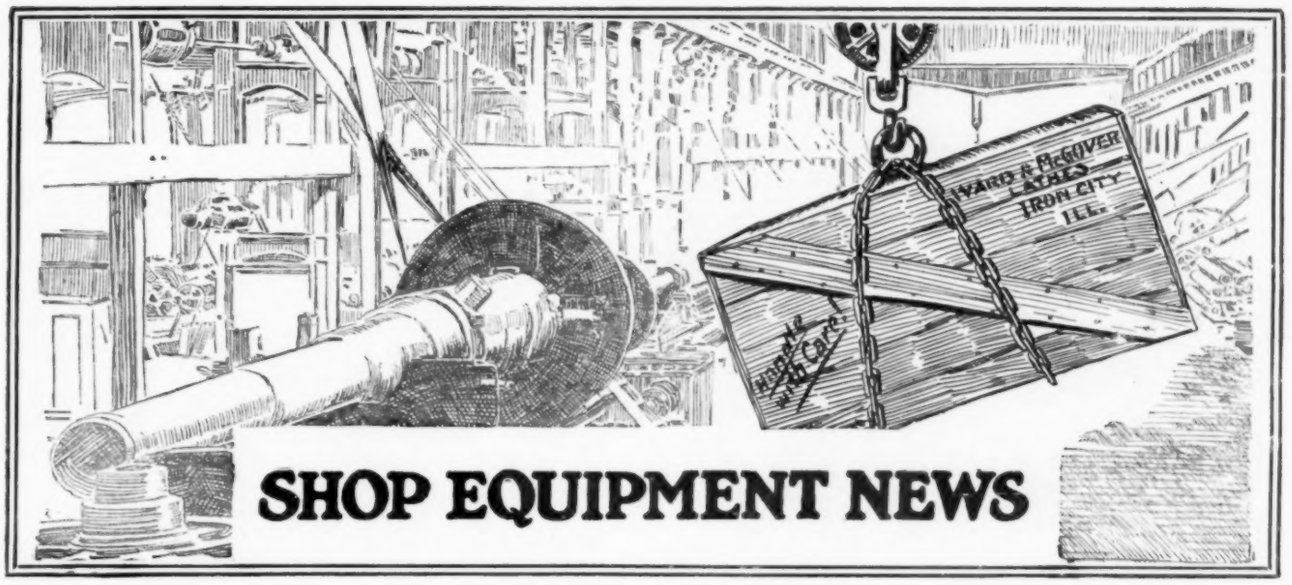
V C KYLBERG
ASSISTANT CHIEF

C E HILDRETH
CHIEF
MACHINE TOOL SECTION OFFICE DIRECTOR OF SALES
P S & T, GENERAL STAFF, WAR DEPARTMENT

APPROVED
E E MORSE
FIRST ASST DIRECTOR OF SALES
PURCHASE, STORAGE AND TRAFFIC DIVISION
GENERAL STAFF, WAR DEPARTMENT

C W KENT
DIRECTOR

MAY 26, 1919 AAD 440



Heald 8- and 12-Inch Rotary Surface-Grinding Machines

Two new rotary surface-grinding machines, the No. 20 with an 8-in. chuck and the No. 22 with a 12-in. chuck, have just been placed on the market by the Heald Machine Co., Worcester, Mass., and while primarily designed for manufacturing purposes, they are capable of producing very accurate and finely finished surfaces. These machines are quite similar, and have been built with the idea of giving a more economical machine than the large-sized ring-grinding machines and also give the same production and finish. The new 8-in. machine is considerably heavier than the other 8-in. machine previously built. They are built massive, but simple, and have all necessary mechanical refinements required to readily obtain the various speeds and adjustments. The wheel slide is a heavy casting, and has flat- and V-ways to assure proper alignment at all times. These bearing surfaces are large and protected from grit and dirt. Another feature that adds greatly to the rigidity is the belt drive, which is so arranged that the downward pull of the belt tends to hold the wheel slide firmly in place.

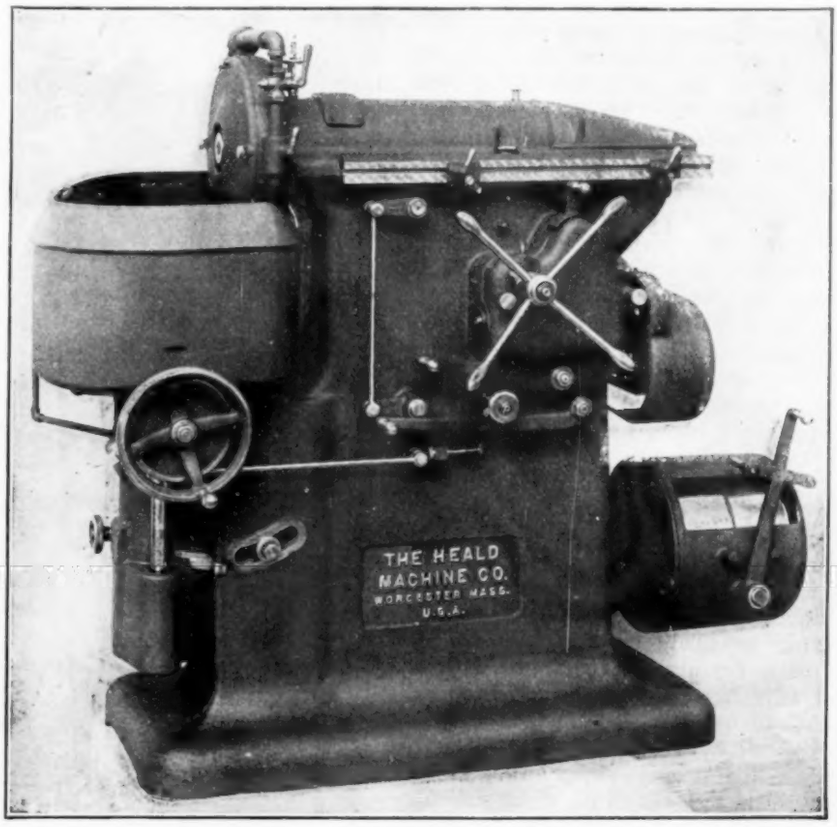


FIG. 1. FRONT VIEW OF THE NEW HEALD ROTARY SURFACE-GRINDING MACHINE

The large wheel spindle is made of chrome-nickel steel and is mounted in a straight, plain, adjustable bronze bearing at the rear. The front bearing is adjustable and can be reached through a hole in the top of the wheel slide, provided for that purpose. The front bearing is lubricated by a sight-feed oiler placed at the right of the wheel guard. Both automatic and hand feeds are provided for the wheel slide through an automatic box of a very simple and rigid design. The main drive bracket is located at the right side of the machine, and receives its power on tight and loose pulleys directly from the main lineshaft. From this bracket the power is transmitted by belt to the main feed box, wheel spindle and pump. The guard over the tight and loose pulleys is adjustable so that the openings can be lined up to suit the belt on any particular drive. The shifting lever can be reached from the operator's position, and is arranged with a spring plunger that locks it in place in either the on or off position. The main speed box is locat-

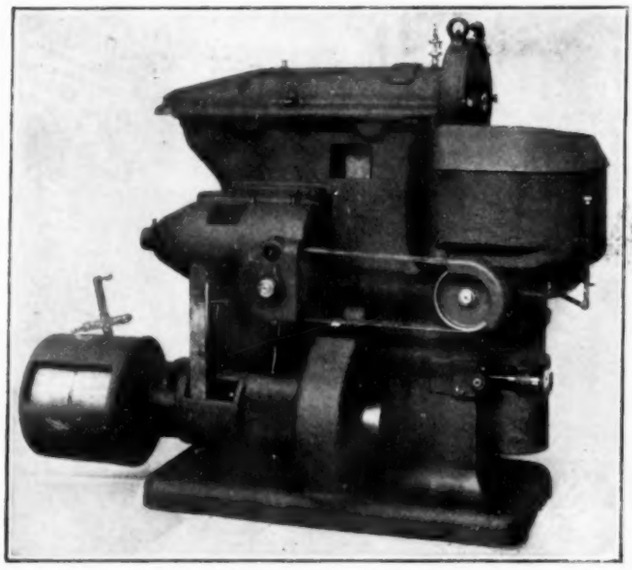


FIG. 2. A REAR VIEW OF THE MACHINE SHOWING VARIOUS FEATURES OF THE DRIVING MECHANISM

Specifications for 8-in. machine: Diameter of magnetic holding surface of standard chuck, 8 in.; face diameter of chuck, 9¼ in.; grinding wheel, 10 in. in diameter with 1 in. face and 3½ in. hole; maximum distance between top of chuck and center of wheel, 8½ in.; maximum distance between top of chuck and face of 10-in. wheel, 3½ in.; minimum diameter grinding wheel used, 6½ in.; vertical adjustment of chuck, 5 in.; maximum swing inside of water pan, 13 in.; floor space for belt drive machine, 48 x 60 in.

Specifications for 12-in. machine: Diameter of magnetic holding surface of standard chuck, 12 in.; face diameter of chuck, 13¾ in.; grinding wheel, 12 in. in diameter with 1½ in. face and 5 in. hole; maximum distance between top of chuck and center of wheel, 10 in.; maximum distance between top of chuck and face of 12-in. wheel, 4 in.; minimum diameter of grinding wheel used, 7½ in.; vertical adjustment of chuck, 5 in.; maximum swing inside of water pan, 16 in.; floor space for belt drive machine, 48 x 70 in.

ed at the rear of the machine and furnishes power to the wheel slide through a set of three-step cone pulleys. It also transmits power to the chuck through a bank of gears giving three speeds. The speeds of the wheel slide and the chuck are independent in order that a great latitude in regard to speeds and feeds may be obtained. The speeds to the chuck are controlled by a pull rod at the front of the machine. A particular feature is that levers and adjustments for the operation of the machine are within easy reach of the operator while standing in the regular working position.

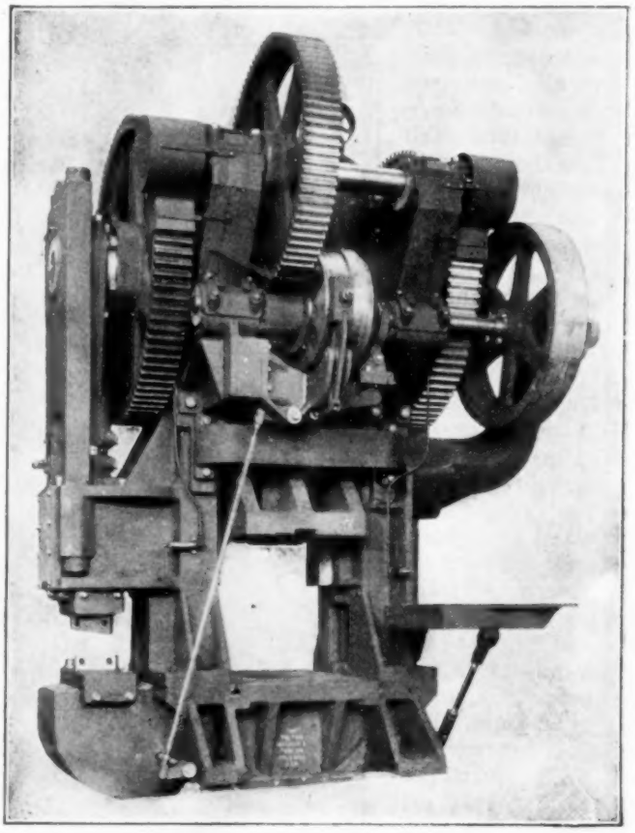
Magnetic chucks, an 8-in. for the No. 20 machine, and a 12-in. for the No. 22 machine are regular equipment, but three-jaw chucks or faceplates with special fixtures may be substituted in case these are more suitable for the work being handled. The chuck spindle is driven by spiral gears, one of which is mounted directly on the spindle, and the chuck bracket is adjustable to permit the grinding of concave or convex surfaces up to an angle of 10 deg. The chuck feed is by means of a handwheel, a vertical screw, and a nut on the spindle sleeve. The chuck spindle is mounted in ball bearings, while the vertical screw has a ball-thrust bearing to allow ease in the vertical adjustment. The machines are also equipped with an automatic vertical adjustment of the chuck that will feed it from 0.0005 to 0.003 in. at the end of each wheel traverse.

The water equipment includes pump, tank, water guard and necessary connections, all of which are furnished as regular equipment. The water guard projects well up over the top of the chuck, and is sloped inward so as to completely protect the operator from splash. The tank is of unusual capacity, giving a large volume of water, while a swivel joint in the distributing nozzle enables the operator to direct the flow to any position.

The machine is entirely self-contained, and requires but a single belt from the main lineshaft or motor.

Toledo Straight-Column Single-Crank Trimming Press

The Toledo Machine and Tool Co., Toledo, Ohio, has just placed on the market what is believed to be the largest single-crank trimming press that has ever been built. The machine weighs approximately 185,000 lb. Not only is the press of unusual size, but it is operated by twin gears on the main shaft. The frame is of four-piece steel tie-rod construction, and consists of a base, two uprights and a crown held together by four steel tie bolts that are heated and shrunk into place, and serve to take the stress when the press is in operation. The uprights are made heavy to withstand any lateral stress that would occur with the slide unevenly loaded. Particular attention is called to the design of the outer shearing-off slide that is operated by an eccentric shaft that extends through the bearing in an auxiliary housing secured to the outside housing by steel tie rods. The clutch is supported on a shaft, and held by a bracket bolted to the frame. This construction affords compactness and rigidity, and does away with the outboard bearing allowing a free space all around the press for access and the handling of material. Lubrication is provided by a forced-feed system permitting operator to lubricate all the important bearings from the floor.

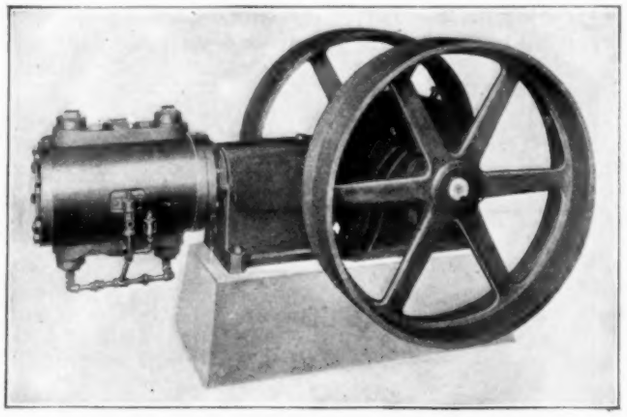


TOLEDO STRAIGHT-COLUMN TRIMMNG PRESS

Stroke, 16 in.; slide flange, 68 in. front to back, 40 in. from right to left; area of bed, 72 in. front to back, 48 in. from right to left; weight, 185,000 lb.

Stratton & Bragg Air Compressors

The illustration shows one of a line of air compressors that has recently been placed on the market by the Stratton & Bragg Co. Petersburg, Va. The compressors are of the single-stage, straight-line center-crank. belt-driven type, moving parts being oiled by the

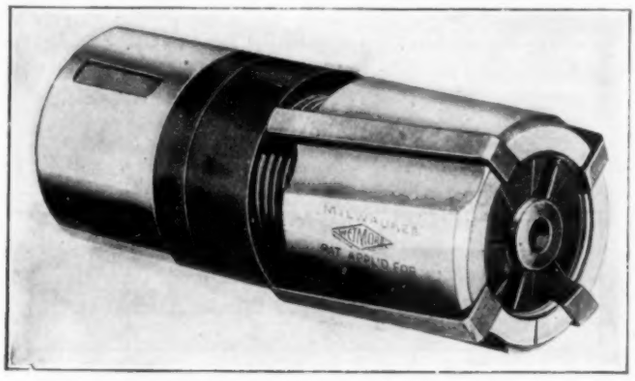


STRATTON & BRAGG AIR COMPRESSOR

splash system. The base of frame is a one-piece casting, to insure rigidity. The main bearings are lined with babbitt hammered and bored to size, and are adjustable. The crankshaft is made of a solid forging of open-hearth steel. The crosshead is of the box type with adjustable brass shoes to take up wear, and the connecting-rod is of openhearth steel. The cylinder is of cast iron, both heads being water-cooled and equipped with automatic valves. An unloading valve is connected with the receiving tank, so that when the desired pressure is attained, this valve acts automatically, holding the intake valves open and relieving the compressor.

Wetmore Expanding Reamers

The outstanding feature of this new line of reamers recently placed on the market by the Wetmore Reamer Co., 210 Syracuse St., Milwaukee, Wis., is the left-hand, spiral cutting angle of the blades, which is stated to have been found particularly well adapted to work where speed and accuracy are required. By means of a wrench provided, a graduated screw collar that is counterbored in the front end of the reamer body may be manipulated to adjust the reamer to the proper size, each graduation on the screw collar indicating the change of 0.001 in. in diameter. No shims, screwdrivers, calipers or other tools are needed for adjustment. The body is solid,

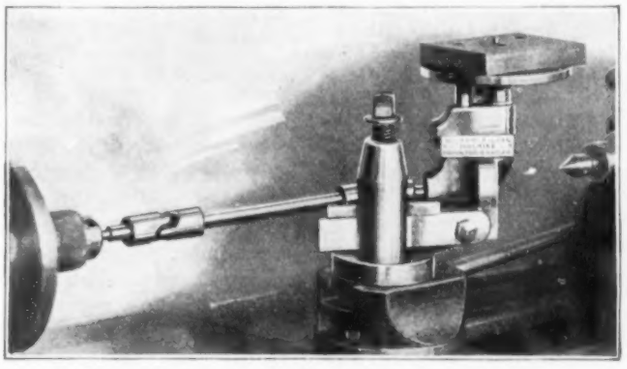


WETMORE ADJUSTABLE REAMER

and it may be attached to any arbor, although arbors are usually furnished; straight-type arbors for lathe reaming, Morse taper arbors for drill-press reaming and floating arbors for turret-lathe reaming. Blades are put up in sets of four or six, depending on the size of the reamer. The reamers are now made in diameters from 1 to 4½ in., four blades being used on sizes up to 3 in. and six blades on the sizes from 3 to 4½ inches.

Boston Rotary Die-Filing Machine

The rotary die-filing device illustrated can be attached to a drilling machine, bench or engine lathe, or can be driven by an independent electric motor, or from a countershaft. It is a product of the Boston Tool and Manufacturing Co., Inc., 262 to 280 Dover St., Boston, Mass., and is intended especially for making dies, tools



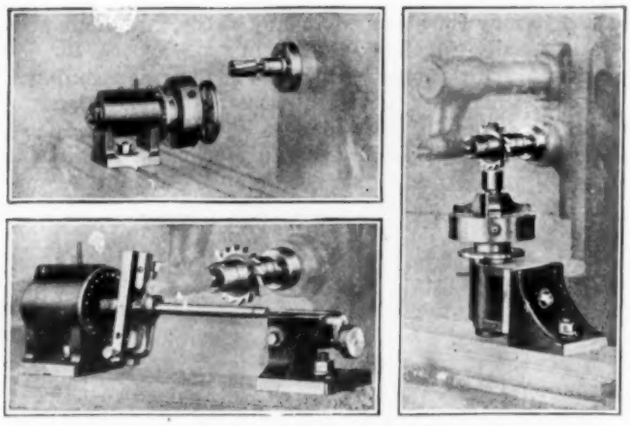
BOSTON ROTARY DIE-FILING MACHINE

Capacity, files and cutters from pin point to ⅜ in. in diameter; thickness of dies finished, up to 1¾ in.; working surface of table, 5 to 8 in. in diameter; height from bench over all, 7 in.; chuck for files or cutters with ¼-in. shanks.

and other work of this character. The machine may also be used for lapping. The device is designed to be held in the toolpost of the lathe or fastened to the table of the drill press, the power being transmitted to the file through a shaft with universal joints. The files can be run at high speed, and needle points can be used as well as larger ones. The table is generally set so that the file just comes through the work and as the chips are drawn down by the motion of the file, the layout is clear and in plain view at all times. Another advantage is that there is no overhead mechanism, and a magnifying glass can be used to advantage.

"Brandt" No. 1 Indexer

Meigs, Miller & Co., Inc., 129 Mill St., Rochester, N. Y., is now marketing the "Brandt" No. 1 indexer shown in the illustration. The features claimed for the device are simplicity, speed of operation, compactness of design, and the rapidity with which angular set-ups with precision can be made. It has positive stops for locating the work, a ball-thrust bearing on the spindle, and a line of fixed angle plates and taper tables. The spindle nose is short to obviate overhang and vibration, and the index plates are interchangeable. It is intended that a special index plate be used for each quantity job, each plate having only the required number of holes. Index plates are furnished up to 25 holes, spaced evenly or unevenly, to suit the needs of any particular job. It is stated that the compactness of the design permits a greater range of work than with the ordinary centers. The special adjustable



BRANDT NO. 1 INDEXER

[illegible]wing on centers, 7 in.; table space required for headstock and [illegible]k, 4 x 4 in.; distance between centers on 36-in. slide, [illegible] diameter of spindle, 25/32 in.; Morse taper in spindle, [illegible] No. 3; weight of headstock, 14 lb.; weight of tailstock, 21 lb.; height in horizontal position, 5¾ in.; height in vertical position, [illegible] in.; distance cutter must be raised to clear tailstock, 1/16 in.

positive work stops enable work to be chucked inside of or through the head to a certain stop, this feature speeding up the insertion of work of this class. The base fits a line of fixed angle plates, and by the use of these any single or combination angular setting can be secured. The plunger for the index plate is actuated by a spring and disengaged by a small lever. The plunger is tapered so that it bottoms in the index hole automatically. The tailstock adjusting screw is a standard screw, two turns of the knob being sufficient to remove the work. The illustrations show how the device may be set in line with the spindle or turned to a vertical position through an angle of 90 deg., by means of the angle plate.

Grinding Attachments for the Potter Precision Bench Lathe

New grinding attachments for the bench lathe have recently been brought out by the S. A. Potter Machine and Tool Works, 79 East 130th St., New York City, which while primarily intended as an addition to the equipment of the Potter precision bench lathe, can be used on any lathe provided with a drum countershaft for driving them. Both external and internal grinding attachments are made to be used on the slide rest and are provided with rockers to allow vertical adjustment. Details of this rocker are shown in Fig. 1.

The attachment for external grinding is also shown in Fig. 1. The spindle runs on ball bearings, and is fitted with caps and felt washers to exclude dust. Adjustment is provided to compensate for wear. It will swing wheels from ¾ in. in diameter up.

The attachment for internal grinding, Fig. 2, while it is to be fastened to the slide rest in the same manner as the other, is not dependent upon it for movement, but has an independently sliding spindle with a movement of about 4 inches.

Owing to the extremely high speed at which the spindle is required to run it was not considered advisable to mount it on ball bearings. All wearing parts of this attachment are of tool steel, hardened and ground. The outer shell forms the bearing for a steel sleeve extending through it, having a tapered journal at the front end, and adjusting locknuts at both ends. The driving pulley is permanently attached to this sleeve at the rear end.

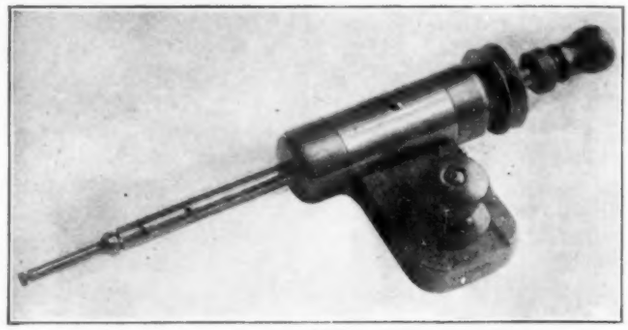


FIG. 2. THE INTERNAL ATTACHMENT

The sleeve has ample bearing surface, and there is an oil chamber at the center which insures proper distribution of lubricant. Brass caps and felt washers exclude dust and abrasive from the bearings.

The wheel spindle slides through the bearing sleeve and is splined to it. On the outer end of the spindle there is a loose wooden knob by which the operator may move the spindle back and forth while grinding.

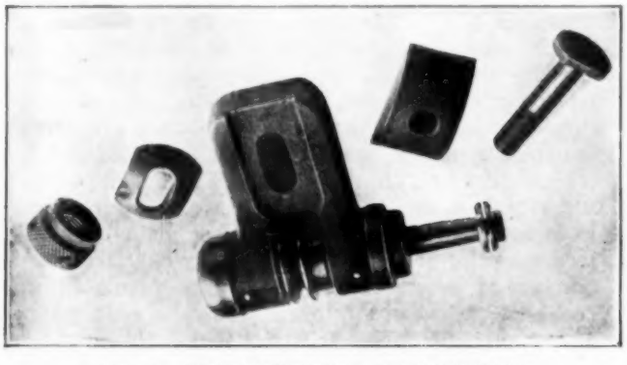
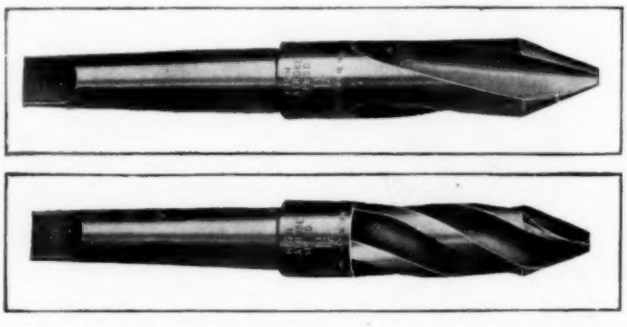


FIG. 1. THE EXTERNAL ATTACHMENT

Latrobe High-Speed Countersink Drills

The Latrobe Tool Co., Latrobe, Penn., is now marketing high-speed steel countersink drills with either three or four flutes, as shown in the illustration. The body of the countersink is made of high-speed steel, and is screwed and solidly brazed into the taper tool-steel shank with the patented Latrobe connection. In this connection the body of the tool is made with a taper-threaded shoulder, and this is screwed and brazed in a taper hole in the shank. The countersinks are made in various sizes, and with points of 15, 37, 45 and 60 deg., included angle.



LATROBE HIGH-SPEED-STEEL COUNTERSINK DRILLS

Why the Railroads Should Be Returned

The President's statement that the railroads were to be returned to their owners has attracted attention to the probable consequences of such a step and various more or less sane predictions have been made as to the outcome. This article is an abstract of a statement by Interstate Commerce Commissioner McChord and gives his personal views on the subject. It should not be taken as an official opinion of the commission which has not as yet committed itself.

THE importance of adequate and efficient transportation systems in this country cannot well be overestimated. The framing of laws that shall give expression to a National policy of regulation of railroad and water transportation for the future involves questions which affect immense property interests, as well as the welfare of the people as a whole.

It is apparent that some of the so-called problems have been needlessly magnified. After all, this is not entirely a new or novel phase of legislative action. For more than 30 years the common carriers of the country by railroad have been operating under more or less effective Federal and state control. The record has been made and is available for use and guidance at this time. Many of the propositions that will be presented should no longer be subject to controversy. They have become settled through court construction, or through recognition of their efficacy by carriers, shippers and the public. There is a disposition upon the part of some people to tear up by the roots the existing system of regulation, and to call for the framing of an entirely new statute, based largely upon new and untried theories. This would be a long step backward and no warrant can be found for such a radical change, judging from the results that have sprung from the regulation we have had. The good in existing laws should be preserved, and where necessary they should be bolstered and reinforced by amendment or addition. Not less, but more efficient regulation is the demand that experience dictates. In order that the public should realize the best results from consistent and just regulation, and in order that common carriers may be in a situation to secure the benefits of such regulation, the railroads, as determined by the President, should be returned to their owners by Jan. 1, 1920.

It has been repeatedly stated by officials high in railway councils, that if the railroad managers were left to themselves they could and would demonstrate their ability to handle and transport the commerce of the country in an efficient and satisfactory manner. When the officials return to duty the roads will have full opportunity to demonstrate their ability to perform as they promise.

I am not an unalterable opponent of government ownership if that becomes necessary and is safeguarded by proper legislation. There might be greater evils attendant upon the settlement of the railroad problem than government ownership. That alternative we can resort to if in the future it becomes imperative. What I do believe is that just now is a very inopportune time to enter upon so stupendous an undertaking. I read that the indebtedness of this country, as a result of the war, will approximate $30,000,000,000. The value of the railroads of the country is about $18,000,000,000. Add to this what the Government is now obligated to pay the railroads under the Federal Control Act in order that they shall be restored to their owners in as good physical and financial condition as when taken over, and a conservative estimate is that the total cost of the transportation systems of the country would not be less than $20,000,000,000. An issue of bonds to pay for the railroads in that sum would increase the National debt to about $50,000,000,000. No one should at such a time as this, when the business and industrial interests are endeavoring to resume business and production on a peace basis, advocate National expenditures on so stupendous a scale. Of course, the Government would operate the roads with no purpose of securing a profit, else the real incentive to such ownership would disappear. Under government ownership the public must pay the bills the same as under private ownership.

Our traditional policy with respect to our railroads has invited the investment of private capital. It is claimed by some that under the impulse of public demand, mingled with the speculative element of the American mind, many railroads were constructed that ought not to have been constructed. Some railroads were improvidently built, resulting in excessive cost; many were the victims of inexcusable and vicious financial manipulation; and many are not so located as to yield any warrant for the conclusion that they can in the immediate future earn a return upon the money invested in them.

In this connection it is well to state that many of the so-called weak roads are either branch lines of great systems, separately operated, or are largely owned by the latter. From reports to the Interstate Commerce Commission for the calendar year, 1917, it appears that railroad companies are among the largest stockholders of railroads. It is true that there are many small roads, and some large weak roads, which are not now in a position to meet a large decrease in revenue that may result from a decrease in business due to transition from a war to a peace basis. But they would be in no worse condition than they would have been had there been no taking over by the Government, except only disorganized management and increased cost of labor and materials.

If we enter upon government ownership now we cannot separate the sheep from the goats and purchase only the former. No railroad is so poor that it does not reach some people who have a right to demand a continuation of service. Many poorly located or poorly managed, or mismanaged railroads, have never earned a return on the money invested in them. If they continue to operate the deficit must be borne by someone. Government ownership is a means of shifting the burden from the owners, where it belongs, to the general public, where it does not belong. Under wise and effective regulation many of the so-called "weak sisters" in the railroad world may be fed and nurtured so as to restore them to some sort of transportation strength. If the protecting hand of the Government is placed on them they will make little effort to better their situation, but will settle down to a condition where they will be a continual drain upon the public treasury. I have never been convinced that government ownership of a losing railroad proposition will transform it into a gainful one. Remove from all the transportation systems of the country the individual initiative, reduce the management to the dead level of one system of management, and we will soon find that the country will have only such service as is absolutely necessary, with no incentive in any particular railroad to excel in any direction. The effort is to make a success of the whole without necessary attention to the success of the parts. The attempt to initiate all rules, regulations and practices, with respect to the operation of individual roads from Washington by one controlling head, could not in the very nature of things result in the most efficient or economical operation. A traffic manager or operating official on the ground, in touch with the situation with first-hand information, is in a far better position to adjust operating problems as they constantly arise. There has not been, and there cannot really be, any denial that the present arrangement is an expensive manner of controlling the transportation systems of the country. The longer it is continued the greater the expense. The longer it is continued the less readily may the railroads be returned to their owners with assurance that they can resume their normal functions with efficiency. There can be no question that physically the sooner the railroads are placed in the hands of their owners the better for them, and the better for the country as a whole.

A representative of substantially all the railroads under Federal control has publicly announced that Federal control and operation of the railroads has destroyed their credit, and that to return them to their private owners without at the same time providing for some sort of Governmental guarantee of earnings would result in disaster. Let us examine this contention.

When the railroads were taken over by the Government they were more prosperous than they had been in the past. To substantiate this, reference may be had to the return made by the railroads themselves to the Interstate Commerce Commission, the results of which have been collected in Table I.

From this table it appears that, considered from the viewpoint of dividend payments, operating income to asserted cost, or surplus accumulations, the railroads were in a more prosperous condition from 1910 to January 1, 1918, than before that period. Under the act passed by Congress the railroads of the country which were taken over by the Government are guaranteed earnings equal to the average operating income for the fiscal years ended June 30, 1915, 1916 and 1917. Thus there is insured to the railroads during the period of Federal control the largest net return as a three-year average ever received by them.

TABLE I. FINANCIAL CONDITION OF THE RAILROADS

	Average Income per Mile of Line	Dividend Rate	Ratio of Income Cost to Cost per Mile of Line	Surplus Accumulations
1900	2,479	5.23	4.53	
1901	2,592	5.26	4.69	
1902	2,776	5.55	5.02	
1903	2,852	5.70	5.19	
1904	2,707	6.09	4.23	
1905	2,896	5.78	5.10	
1906	3,212	6.03	5.58	
1907	3,343	6.23	6.61	
1908	2,841	8.07	4.78	
1909	3,145	6.53	5.34	
1910	3,487	7.50	6.73	$1,371,107,759
1911	3,156	8.03	4.87	1,541,991,152
1912	3,044	7.17	6.62	1,583,032,034
1913	3,420	6.37	6.12	1,767,320,318
1914	2,869	7.97	4.19	1,648,596,111
1915	2,840	6.29	4.09	1,556,787,176
1916	4,050	6.48	6.82	1,935,019,191
1916*	4,277	6.75	6.17	2,159,768,716
1917*	3,811	6.81	5.27	2,628,638,922

*Calendar year.

And it is difficult to understand how there is in this situation anything that can form the basis for a claim that railroad credit has been destroyed by reason of Federal operation.

A guarantee of minimum earnings and a limitation of the amount of earnings have all the evils of government ownership with none of the benefits. If we are to guarantee earnings we might as well enter upon government ownership at once, and repeat the experiences of the government of France. The guarantee system in that country has resulted in a steadily increasing demand on the public treasury. In a recently published statement respecting the guarantee to French railroads F. H. Fayant, assistant to the chairman of the Association of Railway Executives, said:

"But the results of the French guarantee system have been disappointing. There has been no profit-sharing. The Western, after 44 years' continuous appeal to the state on account of its guaranty, became so hopelessly involved in the treasury finances that the state in 1908 was compelled to exercise its purchase option. Incidentally it has become a greater burden to the treasury under state operation than it was under private operation. The Midi (Southern), in the half century prior to the war, was able in only a dozen years to meet its interest and dividends out of earnings. The Paris-Orleans, which at one time had some hopes of becoming self-supporting, was just before the war making large appeals to the treasury. The Est (Eastern) was self-supporting before the war. The Nord (Northern) and the Paris-Lyon-Mediterranean have always been prosperous and had no need of a guaranty.

'State aid in the pioneer days of railroad building in France was of great assistance in providing the capital needed for these enterprises and in bridging the companies over the early lean years, but in later years the guaranty has only served to entangle the weaker roads in politics and public finance. It has been a handicap to progress and has stunted private initiative.

"If we are to retain the advantages of private initiative, and save our transportation system and all our machinery of production from the deadening blight of political meddling, we ought to consider well the dangers involved in any proposal for a financial partnership between the railroads and the Government. While before the war our system of public control had its obvious faults, under it was developed the most perfect transportation machine in the world. The best railroads of Europe are many years behind ours in engineering development and operating efficiency."

It is said that the wages of employees of railroads have been raised to such an extent as to absorb the increased rates initiated by the Director General, and that unless there is some guaranty of increased rates on their return they will not be able to earn the same net income as they were earning when taken over. The figures submitted to the Commission do not show that the carriers are suffering from lack of gross income. In January, 1919, the gross receipts of class 1 railroads exceeded by $111,427,193 the receipts of the same month in 1918. In February, 1919, they exceeded by $61,924,937 those of February, 1918. It does appear that there has been a decline in operating income. This decline is no doubt due in part to increased operating expenses. How much of the increase is due to the fact that there has been a revolution of management and operation cannot be determined with accuracy. Doubtless this change has an important bearing on the matter. The removal of individual supervision and direction from the operation of the railroads of the country has resulted in large increases in operating expenses. The expression of a fear that more effective regulation will deprive the railroads of the country of a just return for service rendered is but a reassertion of the old fear that was given voice before the taking over. The people of this country have ever been, and they are now, ready and willing to pay to the railroads such rates of freight, passenger fares, and other charges for service rendered as shall be just and reasonable. There is no good reason for not believing that just and reasonable rates will be provided for the future. If wages and cost of materials are such as to demand higher freight rates and other charges in order that the railroads shall render adequate and efficient transportation service, the regulating body on being shown the facts can be depended upon to deal justly with the situation.

It is asserted that the carriers of the country during January, February and March of this year did not earn the Government guarantee by some $200,000,000. This assertion is on the assumption of an equal monthly accrual of the annual compensation which the Government must pay the roads. The early months of any year, however, are not equal in earning power to the average per month for the year.

The fallacy of estimating the operating income of any one year by the operating income of the first three months, January, February and March, is graphically illustrated in Table II, which refers to reports of class 1 roads only:

TABLE II. RELATIVE OPERATING INCOMES

Year	Railway Operating Income for First Three Months	Railway Operating Income for 12 Months Based on the First Three Months	Actual Railway Operating Income for Twelve Months	
1912	$137,779,550	$551,118,200	$736,466,326	Fiscal
1913	152,023,732	608,094,928	816,510,793	Fiscal
1914	89,822,685	359,290,740	692,330,572	Fiscal
1915	133,783,495	535,133,980	716,476,186	Fiscal
1916	213,957,378	855,829,512	1,081,556,496	Calendar
1917	189,282,143	757,128,572	970,197,438	Calendar
1918	81,343,850	325,375,460	719,159,540	Calendar

If a comparison is made between the railway-operating income of January, February and March, 1919, and the corresponding months of the test period 1915, 1916 and 1917, it will be found that the income for the first quarter of 1919 was 131 millions less than for the corresponding part of the test period, and for the first quarter of 1918, 98 millions less, or 114 millions as the average of the first quarter of the years 1918 and 1919, and not about 200 million as asserted.

In his statement in a communication addressed to the Secretary of the Treasury made public May 25, the Direc-

tor General, in explaining the deficits for the years 1918 and 1919 in operating revenue under that of the guaranteed return for the first quarter of those years, said:

"The operating deficit for the year 1918 was due largely to two facts: First, the winter of 1918 was unprecedented in its severity and in its costly effect on railroad operations, and second, the increases in passenger and freight rates, averaging about 25 per cent., were in effect for only a few days in excess of six months, while heavily increased expenses due to war conditions were effective on an ascending scale throughout the 12 months.

"The operating deficit for the first four months of 1919 is due in part to the cumulative high levels of cost brought about by the war, for labor and materials and in part to the sudden and abnormal falling off of business as a result of the cessation of war activities, the sudden drop in the demand for fuel and for other basic commodities and the general state of hesitancy due to the transition from war conditions to peace conditions."

In giving the figures and making the comparisons I must not be understood as taking the position that the railroads of the country have earned as much or more than they should have earned or were entitled to earn. My sole effort has been to give the facts as I find them, in order that the situation may be looked squarely in the face, and to ascertain whether there is a foundation for the statement that our railroads will be confronted with bankruptcy should they be restored to their owners.

What is there in the situation that the carriers will occupy on January 1, 1920, that warrants the claim that their being turned back would mean bankruptcy to them? It is said that the outlook is bad, and that the railroads cannot now stand alone. The claim is made that business is at low ebb; that wages and expenses are at high tide; and that to meet that condition there must be a radical reorganization of our transportation systems that shall involve some sort of a guaranty upon the part of the Government that net incomes of all carriers shall never be less than a return on property investment that shall be as great as, or greater than, the average return for the years 1915, 1916 and 1917, without regard to the location of particular lines or their previous financial history.

In the *Railway Age* of May 9, 1919, the following discussion of traffic conditions appears:

"It is true there has been a decline of traffic; and some refer to the business which has been handled thus far this year as abnormally small. It is smaller than that of 1918 or 1917; but conditions in 1917 and 1918 were not normal, and the traffic handled in those years showed a vast increase largely due to war conditions. Let us go back to the first three months of 1916. In that year the railways had the largest increase of traffic that ever occurred in any single year. They made the largest operating income ever made in one year. Every one remembers this. Doubtless, consequently, most people assume that because of the recent decline in traffic the business which has been moved thus far this year has been much less than in the remarkable year 1916. It is somewhat disconcerting, therefore, to find that in the first three months of 1919 the freight traffic of the railways was 85,000,000,000 ton-miles, while in the first three months of 1916 it was only 80,000,000,000 ton-miles, an increase in 1919 over 1916 of over 6 per cent. Furthermore, the traffic handled in the first three months of this year was only 10 per cent. less than that moved in the corresponding three months of 1917 and 1918. The railways moved less freight in February and March of this year than in the same months of 1917 and 1918, but they moved more in January than in either of those years."

There always have been and there will be, periods of business depression. No law that can be conceived or enacted and no tribunal that may be appointed, can control the yield of crops or the production and sale of the industries of the country. Rates of freight or other charges for transportation cannot be so made that they will rise and fall in response to the volume of production from season to season. If the carriers of the country may not be safely returned on January 1, 1920, when in receipt of the guarantee for the preceding two years, it may be asserted with confidence that they never will be in condition to be so returned.

It is a fact that operating expenses have increased during Federal control, due to wage increases, increased cost of materials and supplies, and to unavoidably expensive operation and changed operating and financial management during the war. Unless it is to be assumed that war conditions are to continue indefinitely in times of peace there is bound to be a decrease in operating costs. As pointed out by the Director General in a recent statement, the organization of the carriers is now equipped to handle a much larger business than is offered for transportation. If the railroads are returned there is little doubt that decreases in operating costs can be effected.

It has also been proposed that the Congress shou'd provide for the consolidation or merger of all railroads in a given territory under a Federal charter; all such merged roads to be operated as one. This is only a difference in degree from the National consolidation which now exists as a war necessity. We should go slow in the way of permitting or requiring the consolidation of the railroads of the country. The inevitable tendency in such consolidations is to level down the best in order to level up the poorest. The country had some experience with consolidation in the New York, New Haven & Hartford attempt to consolidate and control all the transportation systems of New England. When the scheme originated the New York, New Haven & Hartford was regarded as one of the best managed and operated railroad systems in the country. Its stocks and bonds were recognized as securities of the highest standard. A citizen who died and was able to leave his family a substantial block of New Haven securities did so with confidence that they were amply protected. Someone devised the consolidation. It was inevitable that one of two things was bound to happen, either that the New Haven bring its consolidated interests up to its high level or that it go down to the lower levels of the others. The latter happened and we see the New Haven's present difficulties.

Slippage of Slushing Oils on Vertical Polished Surfaces

By C. A. Briggs

To a toolman, rust is about as welcome as a toothache. Like the toothache, rust cannot be eliminated, but we have to continue our efforts to alleviate it and to reduce the cause as much as possible.

Some observations made on slushing oils will be of interest to those who have to consider this matter. In experimenting it was found, that when certain specimens of oil were applied to polished metal plates, which were then stood on edge, in a few days' time the coat of oil would slip down, leaving exposed patches of metal surface which were free of any trace of oil and as susceptible to corrosion as though no oil or grease had been applied.

This property of slushing oils and greases is not so rare as might be thought, but has been found in samples from different sources. This characteristic of some oils appears to explain the experience in arsenals where, in the case of guns and machinery covered with slushing oils to prevent corrosion, rust has frequently been found on the top and sides, while the bottom was found in good condition. On account of the top and sides being more or less exposed, the rusting was generally attributed to the oil being rubbed off in some way and the matter was let go at that.

As a result of this discovery, it has been suggested that one of the requirements for slushing oils is that they should pass a test in which they are applied to a polished metal plate and held in a vertical position at any temperature between 15 and 35 deg. C for five days without the slushing oil sliding from the top edge of the plate or leaving any portion of the surface.

Sparks from the

War Taxes Held Due From Makers of Shell Parts

Circuit Court of Appeals Decides that War-Time Tax on Profits of Munition Manufacturers Must Be Paid by Those Who Produced Only Parts of Shells

The policy of the Government involving many millions of dollars in revenue already collected, or in course of collection, was sustained by the Circuit Court of Appeals in Philadelphia on June 9 in a decision holding that the war-time tax on profits of munition manufacturers must be paid by those who produced only parts of shells. The contention was raised by the latter that the impost was intended to apply only to completed articles.

In a group of three decisions the court held that any participant in the abnormal profits of munition making must submit himself to taxation laid upon this class of income. Opposite action by the court would have necessitated legislation to make up the consequent deficit in Federal receipts.

The decisions, written by Judge Buffington and affirmed by Judges Woolley and Haight, who sat with him, sustained the judges of the first and third Pennsylvania districts, who denied claims of the Carbon Steel Co. and the Worth Brothers Co., seeking to recover from the Government, taxes paid under the excise tax law of Sept. 8, 1916, and reversed the justice in the twenty-third district, who allowed a similar claim by the Forged Steel Wheel Co.

Judge Buffington's opinion held that the purpose of Congress was to tax persons who manufactured the whole or any part of a shell, overruling the manufacturers' contention that the legislative intent was confined to the production of the completed shell or a completed part. Its effect is to make munition contractors liable for their profits, regardless of sub-contracts, and to place a similar liability upon all subcontractors doing any part of the work of producing a shell, whether loaded or unloaded.

In general the opinion advanced the rule that where any article which is fitted for general commercial use is taken from that field and segregated for utilization as a war munition, the person carrying out the segregation becomes a manufacturer of war material and as such is liable to the tax.

The opinion also held that decisions of the Federal courts on customs cases, cited by the manufacturers to show that uncompleted parts of manufactured articles were not subject to taxation, did not apply to the act in question, which was declared to be purely a revenue measure, incident to the support of the Government during the war. Judge Buffington pointed out that the customs laws were enacted not primarily for revenue, but to encourage American manufacturers, and where importation of parts of articles to be assembled or manufactured in this country was not in competition with American industry exemptions or reductions of impost duties were proper.

The tax which induced the litigation is "an annual levy of 12½ per cent. upon the entire net profits actually received or accrued from the sale or disposition of such articles (munitions) manufactured within the United States." The impost is in addition to the income tax.

* * *

Source and Distribution of Power

The following power statistics based on the Thirteenth U. S. Census Report will be of interest. The power used in transportation is not included:

Year	Total Horsepower per Each 1,000,000 of Population	Percentage of Distribution of the Total Power Through		
		Steam	Water	Internal Combustion	Electric Motors
1915	482,392	61.2	24.4	14.3	51.0
1909	203,163	76.0	9.8	4.0	25.8
1904	160,760	80.3	12.2	2.1	11.8
1899	132,875	80.6	14.4	1.3	4.9
1889	94,832	77.1	21.1	0.15	0.26
1879	68,182	64.1	35.9	....	....
1869	60,846	51.8	48.2	....	....

The following table giving the percentage of increase of the various prime movers and electric motors during ten-year periods is taken directly from the Thirteenth U. S. Census Report:

Period	Total Hp.	Steam	Water	Gas	Electric Motors
*1915–1909	162.3	111.2	557.7	831.9	5032.0
1909–1899	84.9	74.4	25.4	181.1	877.2
1899–1889	70.0	77.7	15.9	214.5	3066.1
1889–1870	74.1	109.6	2.4	.....	.....
1879–1869	45.4	79.8	8.4	.....	.....

* Six years—(Rushmore).

Below is an estimate of the distribution of power in 1915, as made by Mr. D. B. Rushmore:

	Horsepower	
Horse and mules	25,000,000	
Automobiles	25,000,000	
Steam and naval vessels	5,000,000	
Steam railways	50,000,000	
		105,000,000
Irrigation	500,000	
Mines and quarries	6,000,000	
Flour, grist and saw mills	1,250,000	
Manufactories	25,000,000	
Central stations	8,000,000	
Isolated plants	4,250,000	
Electric railways	4,000,000	
		49,000,000
		154,000,000

The figures 482,392 total horsepower per one million of population in 1915, given in the first table of power statistics, is the sum of the last seven items of the above list divided by 101,577,000, the total continental population in 1915. All other items in the two tables are taken directly from the Census Report.

The Eleventh Annual Convention of the Master Boilermakers' Association

The eleventh annual convention of the Master Boilermakers' Association was held in Chicago, May 26 to 29, 1919, at the Hotel Sherman. The officers in charge of the affairs of this convention were D. A. Lucus, president; John B. Tate, first vice president; Harry D. Vought, secretary, and Frank Gray, treasurer.

The meetings were devoted to lengthy discussions on practical topics presented by a series of special committees which had been created for this purpose. Among the topics discussed were "The Proper Method of Threading Radial Stays and Tapping Holes for Same;" Best Method of Threading and Drilling of Tell-Tale Holes;" and other subjects devoted solely to locomotive design and maintenance. One committee favorably reported the use of the oxy-acetylene gas torch for cutting off staybolt ends instead of using chisels or special nippers for this purpose. Chisel tools are liable to damage the threads while the nippers do not leave a square end, which necessitates dressing up the ends after they have been cut.

The new officers elected for the ensuing year are: John B. Tate, president; Charles P. Patrick, first vice president; Harry D. Vought, secretary, and W. H. Laughridge, treasurer. The location of the next annual convention will be determined some time during the year by the executive board.

* * *

A National Trade-Mark

A bill was introduced in the House recently by Congressman Sims which provides for a trade-mark to be selected by the Secretary of Commerce and which will be known as "The National Trade-Mark." It is to be registered in the Patent Office in the name of the United States of America, without limitation of time and covering all classes of goods which are recognized under trade-mark laws.

The Secretary of Commerce is authorized to issue licenses for the use of the trade-mark under certain rules and regulations to any Amercian manufacturer or producer. He is also given the right to institute and maintain proceedings when the rights of the trade-mark have been infringed upon.

The bill provides for the sum of $25,000 to be used in the expense of carrying the provisions of the act into effect, and has penalties for using any trade-mark similar enough to deceive purchasers into believing it to be the national trade-mark.

World's Industrial Forge

By E.C.Porter, News Editor

Meeting of the Material Handling Machinery Manufacturers' Association

The semi-annual meeting of the Material Handling Machinery Manufacturers' Association was held on June 10 and 11 at the Hotel Astor, New York City. Addresses of unusual interest covering the entire field of equipment suitable for the loading and unloading of ships and for the improvement of docking facilities were given. The keynote of the meetings, however, seemed to be along the lines of establishing cooperation between employers and labor. Several phases of this work were covered by Francis Holly, Director, Bureau of Commercial Economics, Washington, D. C., who, in his address on "Educating the World Masses on Industrial Methods by Moving Pictures Shown all Over the World," told how labor and society as a whole can be educated and informed of manufacturing and business methods by means of motion pictures.

In the open forum session, the discussion was led by David B. Bushnell of the General Electric Co., and many interesting details of problems of trucking and the mechanical handling of materials in manufacturing plants were discussed.

* * *

Advantages of Electric Furnaces in Steel Foundries Discussed

At a recent convention of the American Electro-Chemical Society in New York a discussion was made of the advantages of the electric furnace in the steel foundry, particularly in comparison with the small openhearth and the small converter. W. E. Moore, president of W. E. Moore & Co., engineers, Pittsburgh, in a paper "The Electric Furnace: Its Introduction Into Foundry Practice," made the following comparisons of the physical properties of the three grades of steel together with data as to costs, after a general portrayal of the various operating and metallurgical advantages of the electric furnace:

Electric-furnace steel, when made to the same chemical specification, is always better than other steel. Usually such steel will run 15 per cent. or better in tensile strength or in ductility, depending upon its heat-treatment. It is easier to control the composition, and consequently, electric steel can be made to more accurate specifications than other steel.

The following comparative physical properties of electric furnace versus openhearth steel made to the American Electric Railway "Axle Steel Specifications" is shown by the tests of a prominent metallurgical engineering firm for a large city street-railway line. These steels, after forging, were held one hour at a temperature of 1450 to 1460 deg. F. (785-793 deg. C.), then quenched in 65-deg. oil, then drawn back at 1185 deg. F. (640 deg. C.) and cooled slowly in the furnace.

	A.E.R.A. Standard Specifications	Open-Hearth	Electric Steel
Elastic limit (lb. per sq. in.)	55,000	41,060	64,850
Yield point (lb. per sq. in.)	.....	41,060	64,850
Tensile strength (lb. per sq. in.)	90,000	89,100	105,140
Elongation in 2 in. (per cent.)	22	21.5	22.0
Reduction in area (per cent.)	45	31.74	52.37
Character of fracture	.....	.....	silky cup
Elastic torsion	.....	16,750	35,700
Shearing strength	.....	62,400	76,000

The following is the estimate of operating cost per ton of liquid steel, produced by Pittsburgh 3-ton type electric foundry furnace, in continuous operation, melting heavy steel turnings and superheating the steel to a fluidity suitable for small steel castings:

MELTING STOCK	
1 ton heavy steel turnings—axle turnings	$12.00
1/20 ton (5 per cent.) loss in melting axle turnings	.60
Electric power, 550 kw.-hr. at 1c	5.50
Electrodes, carbon, 20 lb. at 9c. (ante bellum price 4½c.)	1.80
33 lb. of mill scale (used as a decarbonizer)	.09
ADDITIONS	
8 lb. 70 per cent. ferromanganese at 10c.	.80
5 lb. ferrosilicon at 5c.	.50
(Note that spiegel and 20 per cent. ferrosilicon may be substituted at lower cost.)	
½ lb. aluminum	.17
LABOR AND MAINTENANCE	
Wear and tear on refractory roofs and linings at 40c. per ton (some of our users average 20c. per ton)	.40
Furnace labor	1.00
Total cost of liquid steel in the ladle (per ton)	$22.86

* * *

Exhibitors at Lyons Fair

According to the figures furnished by the Lyons fair officials, French exhibitors led the list with 2994 displays, those from the United States coming second with 618. Great Britain had 415, Italy 154, Switzerland 149, Spain 72, and Canada 44. The 4700 total exhibits for this year compared with 3176 for last year, 2614 for 1917, and 1342 for 1916, the initial year, show the rapid growth of the institution.

* * *

Providing for Welfare Work

Home Cotton Mills, 2400 South 2nd St., St. Louis, Mo., a branch of the Bemis Bros. Bag Co., is organizing and installing a large and complete service department to take care of the welfare work being undertaken in the interest of their employees. A complete system of lockers, rest rooms and reading rooms for men and women, also a kitchen and dining room, will be provided for them.

Trade Currents From Western Cities

Holidays in Chicago Cause a Slackening Effect in Machine-Tool Trade—Cleveland Reports the Placing of Large Orders for Equipment

CHICAGO

The holiday at the end of May, coupled with three near holidays on the occasion of the return of large contingents of fighting men, had a decidedly slackening effect on business the first few days in June, which was felt by the machine-tool trade as heavily as at any other time. The recovery which occurred after the first few days of the month was very pronounced, dealers stating that indications point to business in June being as good if not better than in May.

There have been no new large want lists made public, the large corporations, in the main, staying out of the market. Orders for from one to several tools from various small and medium-sized concerns are being booked with surprising regularity.

One feature that works to a good market is the fact that most dealers are able to effect delivery of practically any item that may be called for, their stocks being in excellent condition. If the existing steady demand over a wide range of machines continues for long, however, delivery troubles may again be looked for. One large dealer, even now, complains that calls for tools for immediate shipment have been so heavy that he has been unable to maintain a demonstration shop.

Punch presses and grinding machines seem to be most in demand, although milling machines, boring mills, shaping and planing machines and all sizes of lathes are moving freely. A couple of fairly large air-compressor machines were also sold. Several houses are taking advantage of conditions to put on additional salesmen.

CLEVELAND

The most significant development of the week in this market for machinery and machine tools is the placing of several orders for various equipment ranging from $10,000 to $15,000 each. This is the first week since the armistice was signed that so much business in bulk has been placed here. The orders call for grinding machines, radial drilling machines, milling machines, gear cutting machines, screw machines and planing machines, and are being taken mostly by automobile and automobile-parts makers, rubber and tire manufacturing plants and gear-mold makers. The business has been placed

by firms within a radius of 200 miles of Cleveland. This business is considered unusual for this time of year, but is taken to indicate the prosperous trend in the machinery field which has been looked for since last fall.

The balance of business now being placed here is by various concerns seeking a miscellaneous assortment of material and equipment with which to round out their plants. With the larger orders being placed the trade as a whole is in agreement that the situation here is not quite normal. It is now expected that the coming summer will see a larger amount of "fill-in" business placed than formerly during the hot weather.

A good deal of new business coming forward and being absorbed by local firms is attributed to the fact that consumers are better acquainted with the equipment handled by each individual firm, and in this respect fewer inquiries go unfilled in this district than formerly.

Business Items

The U. S. Tractor and Machinery Co., manufacturers of "Uncle Sam" tractors, governor pulleys and machinery, Menasha, Wis., has completed the first units of its new factory and administration building. The unit completed is 60 x 125 ft., and practically all the equipment has been purchased.

The Hydraulic Press Manufacturing Co., home office and factory Mount Gilead, Ohio, has opened a branch office at Pittsburgh, Penn., in the Union Bank Building. J. E. Holveck is the manager.

The Rome Universal Export Co., Inc., has recently been chartered by the State Department to manufacture machinery, machine tools, etc. The directors are Samuel B. Stevens, Charles E. Simpson and H. J. Hayes, all of Rome, N. Y.

The Chicago offices of the International Oxygen Co. have been removed from 223 Railway Exchange Building to 817-820 Chicago Stock Exchange Building, 30 North La Salle St., Chicago. This office is in charge of Philip G. Wesley.

The pattern shop and general offices of the Wunsch & Washburn Co., mechanical engineers, has been moved to 302-304 McDougal St., Brooklyn, N. Y. The engineering offices of the company are located at 487 Broadway, New York.

The Borden Co., Warren, Ohio, manufacturer of Beaver easy-working die stocks and square-end pipe cutters, has just purchased an Oldsmobile roadster for its representative, George D. Clewell, who covers the New England states, Cleveland and Detroit. Mr. Clewell expects to work his entire territory with the car and in this manner will be able to keep in closer contact with the small towns.

Personals

A. BORSUK, for the last two years superintendent of the Presto Machine Works, Inc., Brooklyn, N. Y., now acts in a similar capacity for the Presto Phono Parts Corp., an allied interest, of which he has been elected vice president.

W. G. BALPH has been appointed manager of the safety-switch section of the Westinghouse Krantz Factory, Brooklyn, N. Y. As head of this section, Mr. Balph will have entire responsibility of the sale of all Krantz products. Prior to working as salesman in the New York office, Mr. Balph was head of the fan-motor division with offices at Pittsburgh, Penn.

H. L. GARBUTT, formerly manager of the line-material section of the Westinghouse Electric and Manufacturing Co., East Pittsburgh, Penn., has been appointed manager of the supply division of the Westinghouse San Francisco office.

ALBERT BRUNT, who for the last four years has been engineer in charge of the direct-current machine design section of the industrial engineering department of the Westinghouse Electric and Manufacturing Co., East Pittsburgh, Penn., has resigned to return to Holland. Mr. Brunt was an active member of the A. I. E. E. and has prepared a number of interesting articles for technical papers on direct-current motors.

L. S. DEVOS, 24 Stone St., New York City, is export manager for the following concerns: Becker Milling Machine Co., Hyde Park, Boston, Mass.; Reed-Prentice Co., Worcester, Mass., and Whitcomb-Blaisdell Co., Worcester, Mass.

JOHN T. SWIFT, president of the Swift Manufacturing Co., has become vice president and financial manager of the Williams Galloway Co., Waterloo, Iowa, manufacturers of gasoline engines, tractors, etc. The company is being reorganized. It was organized in 1906 and now employs 500 men. Plans are being worked out, it is reported, that will give employment to 700 men exclusive of the tractor plant.

GEORGE OSTENDORF, formerly with the Tropical Paint and Oil Co., Cleveland, Ohio, has become associated with the sales organization of the Hilo Varnish Corporation, Brooklyn, N. Y. Mr. Ostendorf will make his headquarters at Cleveland and will look after both the manufacturing and the jobbing trade in northern Ohio.

CHARLES A. GREENE, Chicago representative for the Borden Co., manufacturers of Beaver pipe tools, has opened up a downtown office at Room 501, No. 549 West Washington Boulevard, Chicago. Mr. Greene can be reached promptly by mail or phone at his new headquarters.

H. E. SEWELL, Philadelphia, Penn., has been made salesman for organizing the open territory of the eastern states for the new Hart-Parr tractor. Mr. Sewell will make his headquarters in Philadelphia and will appoint distributors for the New England states, New York and Pennsylvania.

R. S. CARTER, sales manager for the Whitman & Barnes Manufacturing Co., sailed from Halifax aboard the steamship Aquitania, on June 2, for Southampton, from which place he will proceed on a tour of European countries, visiting manufacturers, dealers and jobbers in England, Denmark, Norway, Sweden, Belgium and France. Provided conditions are settled, Mr. Carter plans to go to Petrograd.

A. H. BAUMAN, formerly general foreman of the 1.55-millimeter gun shop at Erie, Penn., has been appointed to a position with the sales department of the Cleveland-Duplex Machinery Co., Cleveland, Ohio, and will have city territory.

Forthcoming Meetings

The thirty-first annual convention of the American Boiler Manufacturers' Association will be held at Lafayette Hotel, Buffalo, N. Y., on Monday and Tuesday, June 23 and 24.

American Foundrymen's Association. Annual convention and exhibit will be held in Philadelphia the week of Sept. 29, 1919. C. E. Hoyt, secretary, 111 W. Monroe St., Chicago, Ill.

The American Railway Association, Mechanical Section, will hold its convention and exhibition at Atlantic City, N. J., June 18-25. Secretary, J. B. Conway, 1841 Oliver Bldg., Pittsburgh, Penn.

The American Railroad Master Tinners', Coppersmiths' and Pipefitters' Association. Annual convention will be held June 23, 24 and 25, 1919, at Marquette Hotel, St. Louis, Mo. The officers of the association are: President, W. J. Moffatt; first vice president, G. B. Hosford; second vice president, W. W. Nash; third vice president, T. E. Holderby; secretary-treasurer, Otto E. Schlinck, 485 W. 5th St., Peru, Ind.

The American Society of Marine Draftsmen will hold its eight annual convention at the Hotel Brunswick, Boston, Mass., on June 20 and 21. B. G. Barnes, 1596 North Ave., Bridgeport, Conn., is the secretary.

American Society of Mechanical Engineers. Spring meeting to be held at Hotel Statler, Detroit, Mich., June 16-19, 1919. Secretary, Calvin Rice, 29 West 39th St., N. Y.

American Society for Testing Materials will hold its twenty-second annual meeting at Atlantic City on June 24-27, headquarters at the Hotel Traymore. Secretary-treasurer, University of Pennsylvania, Philadelphia, Penn.

The International Railroad Master Blacksmith's Association will hold its annual convention in Chicago Aug. 19, 20 and 21. The location of the meeting in Chicago will be announced later.

Philadelphia Foundrymen's Association. Meeting first Wednesday of each month. Manufacturers' Club, Philadelphia, Penn., Howard Evans, secretary, Pier 45, North Philadelphia, Penn.

Rochester Society of Technical Draftsmen. Annual meeting and election of officers to be held June 28. On June 29 Maurice A. Wilder will be the speaker. Secretary, O. L. Angevine, Jr., Rooms 131-137, Sibley Block, Rochester, N. Y.

Rochester Society of Technical Draftsmen. Monthly meeting, last Thursday. O. L. Angevine, Jr., secretary, 857 Genesee St., Rochester, N. Y.

Society of Automotive Engineers. Spring meeting to be held at Ottawa Beach, Mich., June 23-27, 1919. Secretary, Coker Clarkson, 29 West 39th St., New York City.